CHARBROILING ACTIVITY ESTIMATION

DRAFT

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Abstract

The main goal of this exploratory study was to develop a methodology for a statewide estimation of commercial charbroiling and deep-fat frying activity. The study used commercially available facility data and a telephone survey to develop information on a subset of California restaurants determined to be most likely to use charbroilers. Project objectives were to 1) develop a method for estimating spatially and temporally resolved activity data for commercial charbroiling operations throughout California, and 2) to collect sufficiently detailed activity and source mapping data to generate a temporally and spatially specific emission inventory for commercial cooking sources in California. The results of the study suggest that it is possible to use Computer-Assisted Telephone Interviewing (CATI) to successfully survey restaurants for these data. However, a larger sample would be required for detailed estimation purposes due to the diversity of restaurant types, sizes and cooking practices in the state. This report includes conclusions and recommendations for further study.

Introduction

Background

Commercial cooking practices have been identified as contributors to regional particulate matter (PM) and volatile organic compounds (VOC) emissions. These emissions have a negative impact on air quality and human health. The practice of charbroiling in particular has been identified as being a major producer of PM and VOC emissions from restaurant operations, and is thus an area of concern.

The most extensive studies of restaurant operations and their impact on air quality appear to be those conducted by the South Coast Air Quality Management District (SCAQMD) in the Los Angeles area of California. The SCAQMD has sponsored studies measuring the direct output of emissions from various types of cooking equipment when used with different types of food[1], and survey studies of restaurant operations and the extent of use of different types of cooking equipment for cooking different types of food[2]. The combination of the results of these studies has allowed researchers to build a region-specific estimate of total restaurant emissions in the South Coast region.

The SCAQMD reports that while emissions from deep-fat fryers and ovens appear to be negligible, chain-driven charbroilers account for 4% of PM restaurant emissions and 13% of VOC emissions, griddles account for 13% of PM restaurant emissions and 13% of VOC restaurant emissions, and underfired charbroilers account for 83% of PM and 69% of VOC restaurant emissions[3].

Due to concerns about the impact of cooking operations on air quality, the SCAQMD chose to impose controls meant to reduce the emissions produced by chain-driven charbroilers in November of 1997. Chain-driven charbroilers are production-cooking devices most commonly used by national quick service chains/franchises like Burger King and Carl's Jr. While these devices are relatively uncommon (about 4% of restaurants in the South Coast survey conducted by PES reported having them), they are used for cooking very large quantities of meat, especially hamburger. The decision to impose restrictions on this type of equipment had to do with the fact that this was the only type of restaurant equipment for which there was a cost-effective control technology. However, the more common *underfired charbroilers* appear to account for the majority of PM and VOC restaurant emissions. As of 1999, work was underway to develop cost-effective control technologies for these devices as well.

Recent studies, particularly those conducted by CE-CERT, have quantified the level of emissions resulting from the use of different types of equipment for cooking specific types of foods. With the right sort of information on restaurant throughput and equipment types, it should be possible apply the information from the CCERT studies to develop a statewide picture of the overall contribution of these cooking practices to the production of PM and VOC emissions.

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[1] These studies have been conducted by the University of California, College of Engineering Center for Environmental Research and Technology (CE-CERT).

[2] These studies include the 1999 *Detailed Survey of Restaurant Operations in the South Coast Air Basin* by Pacific Environmental Services, Inc.

[3] http://www.aqmd.gov.hb/990519a.html. AQMD Board Meeting Date: May 14, 1999 Agenda No. 19—Report on Feasibility of Emission Reductions from Under-fired Charbroilers.

Objectives

The main goal of this exploratory study was to develop a methodology for a statewide estimation of commercial charbroiling and deep-fat frying activity. The study used commercially available facility data and a telephone survey to develop information on a subset of California restaurants determined to be most likely to use charbroilers. Project objectives were to 1) develop a method for estimating spatially and temporally resolved activity data for commercial charbroiling operations throughout California, and 2) to collect sufficiently detailed activity and source mapping data to generate a temporally and spatially specific emission inventory for commercial cooking sources in California. One of the major assumptions of this study has been that charbroiling activities should be the focus of the research due to their disproportionate production of VOC and PM emissions.

This research sought to:

- Determine the usefulness of the different commercially available lists of restaurant facilities, particularly in terms of categorization of restaurant types, for stratified sampling;
- Test the feasibility of Computer-Assisted Telephone Interviewing (CATI) for conducting this type of study,
- Develop survey questions that would be useful in determining the temporal distribution of throughput;
- Develop a method for estimating throughput on the basis of size and type of establishment and other available existing data;
- Test predictive value of survey questionnaire data.
- Develop a statewide set of maps to display minimum levels of throughput from charbroiling activities.

Review of the Literature

A search for literature on levels of charbroiling and deep-fat frying activity and its spatial and temporal distribution revealed a fair amount of literature on methodologies of identifying and measuring emissions from various sources and the health effects of these emissions, but very little directly related to the levels and distribution of restaurant operations.

One study from the SCAQMD, the 1999 *Detailed Survey of Restaurant Operations in the South Coast Air Basin* by Pacific Environmental Services, Inc. was particularly useful and served as a model for this study. This report to the South Coast Air Quality Management District described a detailed approach to establishing the number of restaurant operations in a geographic area and surveying these restaurants for an estimation of throughput.

There is very little academic research available on the estimation of commercial charbroiling activity and the impact of socio-economic or locational variables on this activity. One example that is somewhat tangentially related to this study is the 1987 journal article "From Hamburger Alley to Hedgerose Heights: Toward a Model of Restaurant Location Dynamics" by Richard Pillsbury, which appeared in the *Professional Geographer*. The Pillsbury article is methodologically rather loose, but makes some interesting observations about how different types of restaurants are sited. This article

was of interest because of the assumption that landuse and socioeconomics would be related to the decision to locate certain types of restaurants in specific areas, and that spatial variables might impact the cooking practices and throughput of restaurants.

Pillsbury found that restaurants were sited according to different locational dynamics depending upon restaurant type. For some restaurant types targeted to serving specific clientele, the socio-economics of the surrounding neighborhood were important to locational decisions because it was assumed that the clientele would be locals. These restaurant types included many chicken and fish restaurants (more likely to be sited in neighborhoods with large African-American populations), Chinese restaurants (more likely to be situated in blue-collar areas), etc. For some restaurant types, accessibility seemed to be the main decision factor. Major chain fast-food restaurants tend to cluster along major traffic arteries and in suburban shopping malls. The existence of major traffic arterials and other fast food restaurants are more important predictors of these types of restaurants than the socio-economics of those living in the area around the restaurants, since the customers of the restaurants are not necessarily local residents. Some specialty restaurants have a somewhat different dynamic, being "destination" restaurants that draw their consumer base from all over rather than specifically from the neighborhood in which they are located. They draw clientele due to a particular ambiance that may be somewhat related to the neighborhood or area in which they are located, although not dependent upon local residents for a customer base.

The Pillsbury article was published before desktop GIS became widely available. Opportunities for further investigation of spatial factors and demographic factors affecting restaurant location, and the related topics of restaurant operations and throughput, seem promising. There are undoubtedly numerous proprietary market studies investigating these topics for restaurant placement prepared for individual chains and restaurateurs that are unavailable to the general public.

Materials and Methods

The survey part of this study was based on the SCAQMD Survey of Restaurant Operations in the South Coast Air Basin (Pacific Environmental Services, Inc., 1999). Instead of conducting a mail survey as PES did, Public Research Institute (PRI) conducted a Computer-Assisted Telephone Interview (CATI) survey with questions based upon those used for the SCAQMD study, with some major modifications. PRI used a database of California restaurants from Dun & Bradstreet, a vendor of business information data.

Questionnaire

To gather data about cooking practices from a sample of California restaurants, PRI adapted a questionnaire initially developed by Pacific Environmental Services, Inc. in 1998 for the South Coast Air Quality Management District. PRI adapted the original self-administered survey for telephone administration. PRI made a number of changes to the survey instrument in order to address additional issues of interest not covered in the South Coast study, and to reduce the overall length of the interview. Appendix A

includes a copy of the survey questionnaire. Survey questions were organized into the following general categories:

- **Introduction, Screening and General Background Information:** Identifying the right person with whom to conduct the survey was very important to gathering valid and accurate data. Interviewers were provided with a contact name and telephone number from the Dun & Bradstreet database of California restaurants. If the named person could not be located, interviewers were instructed to ask for another owner or manager who would be able to answer the questions accurately and knowledgeably. To screen out espresso houses, ice cream shops, sandwich shops and other facilities that were unlikely to cook meat on the premises, respondents were asked whether or not they cooked meat at their restaurant. Only those that cooked meat were surveyed. Respondents were asked whether the Dun & Bradstreet category assigned to them was appropriate. If it was not, they were asked to give the correct categorization. Respondents were asked whether they considered their restaurants part of a chain or franchise or an independent restaurant. Finally, they were asked to identify which types of meat they cooked at their restaurant. This question set up the skip patterns for the next series of questions so that respondents would not be asked questions about types of meat that they did not cook.
- **Types of Equipment Used and Amounts of Meat Cooked**: While the SCAQMD survey asked restaurateurs about a range of cooking equipment including ovens, ranges, deep-fat fryers, grills/griddles, charbroilers and pit barbecues, the PRI study only asked about 5 types of equipment for which there are CCERT calculations for emissions. These equipment types are charbroilers (underfired and chain), deep fat fryers, grills/griddles (flat and clamshell). Respondents were asked to give the number of pieces of the named equipment that they might have. If they gave a number greater than zero, they would also be asked a series of questions about how many pounds of different types of meat they cooked in an average week on the named equipment. They were also asked about the fuel source for that type of equipment, and how they arrived at their estimate of pounds of meat cooked per week.
- **Days of Operation and Number of Customers Served:** Respondents were asked about the days of week during which they were open, the amount of meat they cooked on a typical weekend, the busiest meal on weekends, the busiest meal on a typical weekday, and how many customers they served during a typical week.
- **Extent of Knowledge About the Connection Between Commercial Cooking and Air Quality:** At the end of the survey, respondents were asked a series of questions to ascertain their level of knowledge about the impact of commercial cooking on air quality and to determine whether they had heard any information about possible regulation of cooking practices. If respondents answered affirmatively to this question, they were asked to identify what they had heard about the connection between cooking and air quality, and what was the source of the information.

Because PRI purchased sample from a business information vendor (Dun & Bradstreet), PRI had access to additional information about respondents including the number of employees at each site and the annual sales volume.

Design and Selection of the Survey Sample

The sampling frame for this survey was a subset of all restaurants in the state of California. Because of cost restrictions, it was not possible to adequately survey a stratified sample of *all* restaurant types in the state. A subset of restaurants most likely to employ charbroilers was identified for the purposes of the survey. Charbroilers have been identified as being a major producer of PM10 and VOC emissions from restaurant operations, and are therefore a major focus of this study. The results of this study should provide a baseline minimum for estimates of emissions resulting from commercial cooking.

An important element of this study was the identification of a business data vendor with adequate categorization of restaurant types for stratification. The researchers working on the SCAQMD study encountered significant difficulty using data from American Business Information (now InfoUSA) due to its vague categorization scheme. Nearly 75% of all restaurants from the ABI sample for the study area were grouped into the catchall category of "restaurants". Furthermore, respondents in the study often disagreed with ABI's categorization of their restaurant type. The restaurant categorizing schemes of several major vendors were investigated for the purposes of this study. (See Appendix D.) ABI provided us with a list of a total of 17 different categories of Eating and Drinking places. These included general categories such as "restaurants" and "Foods-Carry Out". Claritas provided us with a list originating from ABI with identical categories to those provided by ABI. Genesys provided us a list of restaurant categories originally generated by ABI, but further divided into categories by Franchise (29 categories for franchises such as Applebee's or Taco Bell) or by Specialty (27 categories for specialties such as Barbecue, Thai, and Brew Pub). Dun & Bradstreet provided us with a list of Eating and Drinking Places broken out into 68 detailed categories under general headings such as ethnic food restaurants, fast food restaurants and Stands, family restaurants, etc. The Dun & Bradstreet database was chosen because the breakdown of restaurant categories seemed more detailed and careful than that used by other vendors. This choice was validated by survey results in at least one respect: only 7.7% of respondents surveyed indicated that the Dun & Bradstreet category assigned to them was not the one they would have chosen to describe their restaurant. (See Appendix D for samples of restaurant categories from the different data vendors.)

We asked a number of restaurant experts to identify which restaurant types from the Dun & Bradstreet categories list would be the most likely to use charbroilers. These experts included:

Richard Young, PG&E Food Service Technology Center

- Beth Klein, Librarian, California Culinary Academy
- John Boral, Chilis Restaurants and Food Service, lecturer at San Francisco State University
- Mike Prosio, Deputy Director, Government Affairs, California Restaurant Association

Of the 60 possible detailed categories of eating places[4] offered by D&B, a total of 29 categories were chosen including all ethnic restaurants except Sushi bars and French restaurants[5] (17 types); all seafood restaurants (2 types); all Steak and Barbecue restaurants (2 types); all "family" restaurants (2 types); Drive-In, fast food Chains and Independents, Grills, and Hamburger stands (all subcategories of "fast food restaurants"); and chicken restaurants (subcategory of "Eating Places, nec."). Data from the survey suggest that these restaurants *are* more likely to have at least one charbroiler on the premises (50.4% do compared to 35% in the SCAQMD survey of all restaurant types in the South Coast area).

This population of restaurants represents approximately 31% of all California restaurants in Dun & Bradstreet's database (13,741/44,227). Identifying the total population of restaurants or "Eating Places" in the state presents problems, and identifying the total population of eating places within subcategories has been virtually impossible due to the different ways data vendors and the U.S. Census categorize restaurant types. Therefore, assessing the accuracy and coverage of Dun & Bradstreet's data has been somewhat challenging.

For example, 1992 breakdown of restaurants by menu type from the U.S. Census identified 41,263 restaurants by menu type[6]. The 1997 County Business Patterns identify 50,299 "Eating Places" in the state of California. InfoUSA and Claritas identified more than 60,000 restaurants in 2000. The California Restaurant Association (CRA) identified 73,850 eating *and* drinking places in 2001. Dun & Bradstreet identified a total of 44,227 eating places statewide in 2000. Dun & Bradstreet lists a total of 8,389 ethnic food restaurants in the state of California (19% of the restaurants in their list) while the census found 11,921 sit-down and 4,149 quick service ethnic food establishments in the state, or 38% of all restaurants in the state (1992). Dun & Bradstreet sales representatives claim that this discrepancy in numbers is due to the fact that they constantly update their lists, thereby eliminating restaurants that have gone out of business while the other sources are not as diligent in removing these defunct businesses from their lists. The disparity in the percent of restaurants classified as ethnic may be due to differences in classification schemes[7].

Cases were sampled proportionate to population from within the selected groups (Ethnic, fast food, family, seafood, and steak and barbecue)[8]. It was determined that a minimum of 400 completes were needed based on a confidence interval of 95%, a population proportion of .5, and plus or minus 5%. A sample of 5,000 restaurants was drawn and split into 10 replicates of approximately 500 cases apiece.

Survey Administration and Response Rate

Computer-assisted telephone interviewing for this survey commenced in mid-January 2001 and continued through the middle of February. Most calling was

[4] Drinking places were excluded altogether.
[5] We were told that these categories were unlikely to utilize charbroilers.
[6] http://www.calrest.org/fastfacts/segmentdata.html
[7] Fast Food "Ethnic" chains were sometimes classified as "Fast Food" and sometimes classified as "Ethnic Restaurant—Mexican" in the Dun & Bradstreet database.
[8] Chicken restaurants were re-categorized as "Fast Food" since nearly all of the restaurants listed were large quick-serve restaurants such as Popeye's and KFC.

conducted between 8:00 am and 11:00 am, and 2:00 pm and 4:30 pm. Interviewers attempted to locate contacts identified in the Dun & Bradstreet database. If the listed person was not available, interviewers asked to speak with another manager or owner on site. A maximum of eight attempts were made to contact each case.

A total of 655 interviews were completed for an overall response rate of 41% and an overall cooperation rate of 61% (see Table 1 below). The response rate to this survey was higher than expected.

The sample of 5,000 cases was split into ten replicates for loading into the CATI system. Because of the relatively high response rate, less of the sample was used than had been anticipated—only five of the replicates were used.

Table 1--Cooperation Rate and Response Rate, Calculated from American Association of Public Opinion Research Standard Definitions

AAPOR Cooperation Rate #1	=I/(I+P)+R+O =655/(655+0)+419+0
AAPOR Response Rate #3	=I/(I+P)+(R+NC+O)+e(UH+UO) =sum(655/((655+0)+(419+0+0)+(.8325*636)))

Where:

I = Complete interview (1.1)
P = Partial interview (1.2)
R = Refusal and break-off (2.10)
NC = Non-contact (2.20)
O = Other (2.30)
UH = Unknown if household/occupied HU (3.10)
UO = Unknown, other (3.20)

e = Estimated proportion of cases of unknown eligibility that are eligible
e=(1-(tot not eligible/total sample records-total unknown eligibility))
0.832463011

Table 2--Final Disposition Tally for CATI Survey

FINAL DISPOSITION TALLY		
	Total Sample Records Used:	2069
	Total Sample Records:	2298
AAPOR #		
1.00	**Total Interviews**	**655**
1.10	Complete	655
1.20	Partial	0
2.00	**Total Eligible, Non-Interview**	**623**
2.10	Total Refusals	419
2.11	Initial Refusal	212
2.11	Hard Refusal	207
2.10	Break-off	0
2.20	Non-contact	0
2.21	Callbacks/Respondent not available	179
2.22	Answering Machine	25
2.32	Physically or mentally unable/incompetent	0
2.30	Other eligible non-interview	0
3.00	**Total Unknown Eligibility, Non-Interview**	**636**
3.11	Not attempted or worked	229
3.12	Always busy	24
3.13	No answer	43
3.14	Telephone answering device	0
3.15	Blocked call	0
	Language problems (if survey does not specifically call for languages; see AAPOR report for details)	116
	Number over max. attempts (8 attempts)	224
	Other unknown eligibility	0
4.00	**Total Not Eligible**	**385**
4.20	Fax/data line	35
4.32	Disconnected number	135
4.41	Number changed	2
4.42	Cell phone	0
4.44	Pagers	0
4.52	Residential phone	64
4.70	No eligible respondent available	2
4.80	Quota filled	0
	Other not eligible	147

The survey population was not significantly different from the sample population. A number of restaurants were not surveyed because they said that they did not cook meat on the premises.

Table 3--Comparison of Survey Sample and Survey Completes

Main Restaurant Category by Sample Status.

		Completed Surveyed			
		Not Surveyed	Surveyed	No Meat	Total
Main Type	Ethnic food restaurant	7333	381	19	7733
		56.2%	58.0%	76.0%	56.3%
	Fast food restaurant	3500	157	4	3661
		26.8%	23.9%	16.0%	26.6%
	Family restaurant	1232	71	2	1305
		9.4%	10.8%	8.0%	9.5%
	Seafood restaurant	491	19		510
		3.8%	2.9%		3.7%
	Steak & Barbecue restaurant	501	29		530
		3.8%	4.4%		3.9%
Total		13057	657	25	13739
		100.0%	100.0%	100.0%	100.0%

Results

Most numeric survey estimates in this study are *upwardly skewed*, that is, a small number of larger restaurants is associated with substantially higher responses for questions concerning amounts of equipment and meat cooked. For this reason, the arithmetic mean (average) is not always the best estimate for any given restaurant. In addition to the arithmetic mean, we report the *geometric mean* (the mean of the log-transformed variable, re-expressed in the original metric) because it is less biased by extreme scores. The arithmetic mean is more appropriate for estimating population totals, but the geometric mean is more appropriate for estimates concerning individual restaurants.

Types and Numbers of Pieces of Equipment Used

Respondents were asked how many underfired and chain-driven charbroilers, deep-fat fryers, clamshell and flat griddles or grill-tops they have. Respondents were also asked to give the heat source for each type of equipment.

Types of Equipment Used

Fast food restaurants were the most likely to have chain-driven charbroilers and clamshell griddles, equipment types intended for production cooking, whereas nearly all restaurants reported having at least one deep-fat fryer.

Table 4--Percent of Each Type of Restaurant With This Type of Cooking Equipment

Restaurant Category	Chain-Driven Charbroilers	Underfired Charbroilers	Deep-Fat Fryers	Flat Griddles	Clamshell Griddles
Fast Food	18.6%	30.8%	96.8%	51.9%	14.7%
Seafood	0.0%	52.6%	100.0%	36.8%	10.5%
Ethnic	3.5%	47.5%	81.9%	62.7%	4.0%
Steak & BBQ	6.9%	55.2%	82.8%	89.7%	0.0%
Family	10.1%	60.9%	91.4%	82.9%	1.4%
Total	7.9%	45.4%	87.3%	62.7%	6.3%

N = 655

Number of Pieces of Equipment Used

The following table reports the average number of pieces of equipment per restaurant for restaurants having at least one piece of this type of equipment.

Table 5--Average Number of Pieces of Cooking Equipment by Restaurant Category

	Charbroiler	Chain-driven Charbroiler	Under-fired Charbroiler	Deep-fat Fryer	Griddle	Flat Griddle	Clamshell Griddle
Ethnic	1.54	1.62	1.54	1.63	1.87	1.88	1.80
(Geometric Mean)	*1.32*	*1.48*	*1.31*	*1.50*	*1.50*	*1.49*	*1.62*
Fast Food	1.39	1.07	1.58	3.10	1.58	1.43	2.09
(Geometric Mean)	*1.26*	*1.06*	*1.39*	*2.80*	*1.45*	*1.31*	*2.04*
Family	1.35	1.71	1.29	2.34	2.03	2.03	--
(Geometric Mean)	*1.24*	*1.58*	*1.18*	*2.15*	*1.84*	*1.84*	*--*
Seafood	1.10	--	1.10	2.47	1.11	--	1.50
(Geometric Mean)	*1.08*	*--*	*1.08*	*2.35*	*1.09*	*--*	*1.45*
Steak & Barbecue	1.56	--	1.63	2.42	1.35	1.35	--
(Geometric Mean)	*1.46*	*--*	*1.53*	*2.20*	*1.29*	*1.29*	*--*
Overall	**1.47**	**1.29**	**1.50**	**2.16**	**1.78**	**1.76**	**1.95**
(Geometric Mean)	*1.30*	*1.225*	*1.31*	*1.93*	*1.51*	*1.48*	*1.85*

Heat Sources for Equipment

Natural gas was by far the most common heat source for equipment used by survey respondents. Electricity was the second most popular source, while propane, wood and charcoal were rarely mentioned.

Table 6--Heat Source by Equipment Type

	Gas	Electricity	Propane	Wood	Charcoal	Don't know
Underfired charbroiler	90.1%	3.1%	2.4%	2.7%	1.4%	0.3%
Chain-driven charbroiler	86.3%	11.8%	0.0%	0.0%	0.0%	2.0%
Deep-fat fryer	82.1%	15.6%	1.6%	0.0%	0.0%	0.5%
Flat griddle	86.3%	9.0%	2.9%	0.7%	0.5%	0.5%
Clamshell griddle	70.7%	29.3%	0.0%	0.0%	0.0%	0.0%

Types and Amounts of Meat Cooked by Restaurants

Near the start of the survey, respondents were asked to identify whether they cooked any meat at their restaurant. If they did not cook meat, they were not surveyed. If they did cook meat, they were asked which types of meat were cooked at their restaurant. This question set up the skip patterns for the next series of questions so that respondents would not be asked questions about types of meat that they did not cook. Respondents were then asked to give the number of pieces of the named equipment (chain-driven or underfired charbroilers, deep fat-fryers, clamshell griddles, or flat griddles) that they might have. If they gave a number greater than zero for any equipment type, they would also be asked a series of questions about how many pounds of the named types of meat they cooked in an average week on the named equipment. They were also asked how they arrived at their estimate of pounds of meat cooked.

Does the Restaurant Cook Any Meat?

To screen out espresso houses, ice cream shops, sandwich shops and other facilities that were unlikely to cook meat on the premises, restaurants were asked whether or not they cooked meat at their restaurant. Only those that cooked meat were surveyed. A total of twenty-five restaurants reported that they did not cook any meat. Some difficulties were encountered with this question in the pretest and it had to be changed to provide further definition of the word "meat" to include poultry and seafood. A few respondents, including a Kentucky Fried Chicken restaurant, interpreted the word "meat" to mean red meat only.

Most of the restaurants that said that they did not cook meat were ethnic food restaurants. Several pizza restaurants, two Jack-In-The-Box restaurants and a large number of taquerias/Mexican food restaurants said that they did not cook any meat. Eight Taco Bell restaurants reported that they did not cook any meat on the premises. The respondents said that the meat was cooked elsewhere and delivered to them to reheat only. However, ten Taco Bell restaurants also completed the survey because they indicated that they *did* cook meat on the premises.

Numbers of Meat Types Cooked

Respondents were asked whether they cooked steak, hamburger, poultry with or without skin, pork, seafood or other meat. About 62% of restaurants reported cooking four or more types of meat[9]. The number of types of meat cooked was related to restaurant type: approximately 60% of fast food restaurants and 58% of seafood restaurants reported cooking three or less types of meat.

Table 7--Number of Meat Types Cooked

		Frequency	Valid Percent
Valid	1.00	42	6.4
	2.00	79	12.1
	3.00	130	19.8
	4.00	164	25.0
	5.00	136	20.8
	6.00	95	14.5
	7.00	9	1.4
	Total	655	100.0

[9] This is in contrast to the findings of the SCAQMD study by PES, Inc., which found that very few restaurants cooked more than 2-3 of the types of meat surveyed.

A total of 86% of steak and barbecue restaurants, and 90% of family restaurants reported cooking at least four different types of meat.

Table 8--Number of Meat Types by Restaurant Category

	numbers of meat types				Total	
	three or less		More than three			
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Ethnic	136	35.8%	244	64.2%	380	100.0%
Fast Food	93	59.2%	64	40.8%	157	100.0%
Family	7	10.0%	63	90.0%	70	100.0%
Seafood	11	57.9%	8	42.1%	19	100.0%
Steak&BBQ	4	13.8%	25	86.2%	29	100.0%
Total	251	38.3%	404	61.7%	655	100.0%

Types of Meat Cooked

The most commonly cooked type of food was poultry without skin (80% of respondents reported cooking it), followed by seafood, steak and pork (see Table 9).

Table 9--Percent of Restaurants Cooking Each Type of Meat by Restaurant Category

	Steak	Ham-burger	Poultry with Skin	Poultry w/o Skin	Pork	Seafood	Other Types of Meat
Ethnic	76.6%	36.6%	41.1%	84.5%	72.9%	77.1%	11.3%
Fast Food	37.6%	77.1%	35.0%	70.7%	43.3%	42.0%	4.5%
Family	98.6%	90.0%	51.4%	81.4%	85.7%	82.9%	4.3%
Seafood	52.6%	42.1%	31.6%	57.9%	31.6%	100.0%	5.3%
Steak & BBQ	86.2%	62.1%	72.4%	82.8%	100.0%	79.3%	17.2%
Total	**69.3%**	**53.3%**	**41.8%**	**80.0%**	**67.2%**	**70.1%**	**9.0%**
							N = 655

While relatively few fast-food restaurants cooked steak, the vast majority of family and steak and barbecue restaurants did so. Some "steak and barbecue" restaurants did not cook steak. These restaurants were primarily barbecue restaurants specializing in pork, chicken and hamburger. Fast-food restaurants (77.1%) and family restaurants (90%) were the most likely to cook hamburger[10]. steak and barbecue restaurants as a group were most likely to cook poultry with skin (72%). However, more detailed breakdowns revealed that within fast-food, nearly all (90%+) of "chicken restaurants" (KFC, Church's, El Pollo Loco) cooked chicken with skin. Most "chicken restaurants" reported

[10] "Family" restaurants as a category were generally informal sit-down style restaurants like Coco's, Denny's and Carrows.

that they *did not* cook poultry without skin, while nearly every other category of restaurant except seafood restaurants reported cooking poultry without skin.

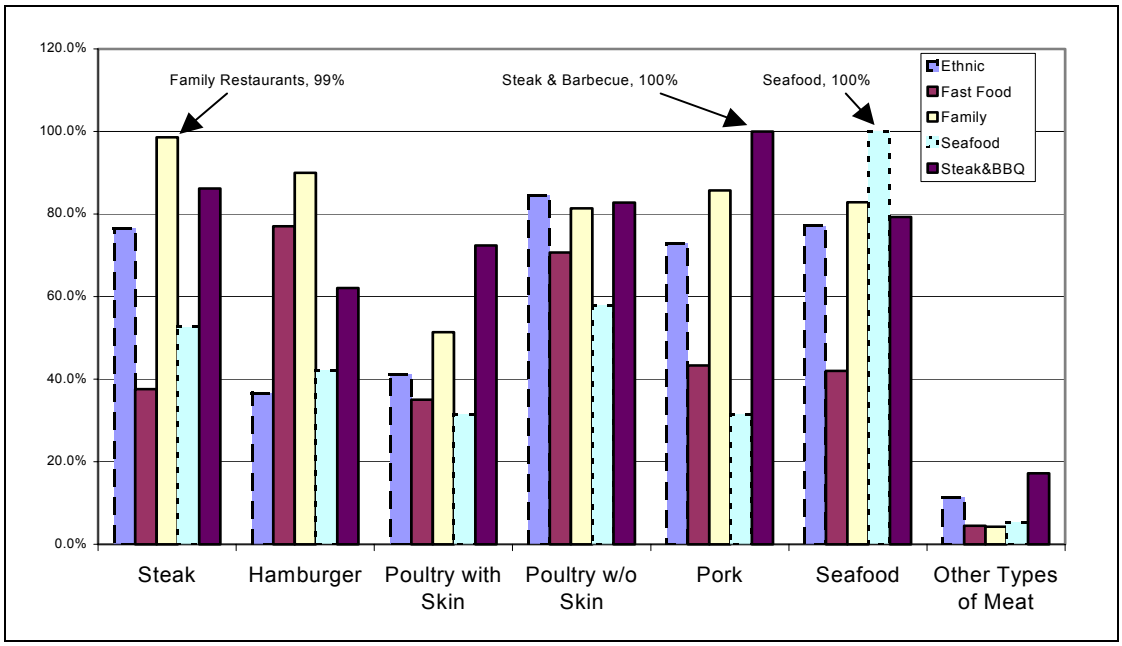

Figure 1--Percent of Restaurants Cooking Each Type of Meat by Restaurant Category

About 9% of restaurants said that they cooked some other type of meat. Some of these cases were a result of a misunderstanding of the named meat categories—a fairly sizable number of respondents answered with a particular cut of beef (for example, "tri-tip"). However, the most commonly mentioned "other" meat was lamb. About 4% of restaurants cooked lamb. Another 2% cooked veal, and 1% venison. Some more exotic meat types included buffalo, ostrich, alligator and goat. Ethnic food restaurants (11%) and steak and barbecue restaurants (17%) cooked the most "other" meat.

Respondent Method of Estimating Pounds of Meat

About 48% of restaurants based their estimates of pounds of meat on "a rough guess" (46%) or said that they did not know how they came to their estimate (1.5%). About 52% of restaurants based their estimate on records of some sort.

Restaurants using chain-driven or underfired charbroilers were no more or less likely to base their estimates on a rough guess than were other restaurants. However, a significantly larger percentage of independent restaurants based their estimates on a rough guess than did chain/franchise restaurants. (See Table 11 below.) It is likely that chains/franchises have better equipment and systems in place to track purchases, throughput and sales than many small independent restaurants.

Table 10--Source of Estimate

	N	Percent
Records of pounds of meat used	75	14.5%
Sales history and menu mix	97	18.8%
Calculated from amount spent on food	97	18.8%
A rough guess	237	45.9%
Don't know	8	1.6%
Refused	2	.4%
Total	516	100.0%

Table 11--Source of Estimate by Restaurant Type

	Records of pounds of meat used	Sales history and menu mix	Calculated from amount spent on food	A rough guess	Don't know	Refused	Frequency	Percent
Family	17%	36%	10%	34%	2%	--	58	100%
Fast Food	12%	22%	21%	41%	3%	1%	128	100%
Ethnic	16%	15%	21%	47%	1%	0%	297	100%
Seafood	13%	13%	13%	56%	6%	--	16	100%
Steak & BBQ	4%	7%	11%	78%	--	--	27	100%
Chain Driven Charbroiler	21%	14%	16%	47%	2%	--	43	100%
Underfired Charbroiler	13%	19%	19%	48%	0%	0%	267	100%
Independent	14%	14%	17%	52%	2%	1%	332	100%
Chain/Franchise	15%	26%	22%	36%	1%	--	194	100%
Total	**15%**	**19%**	**19%**	**46%**	**2%**	**0%**	**526**	**100%**

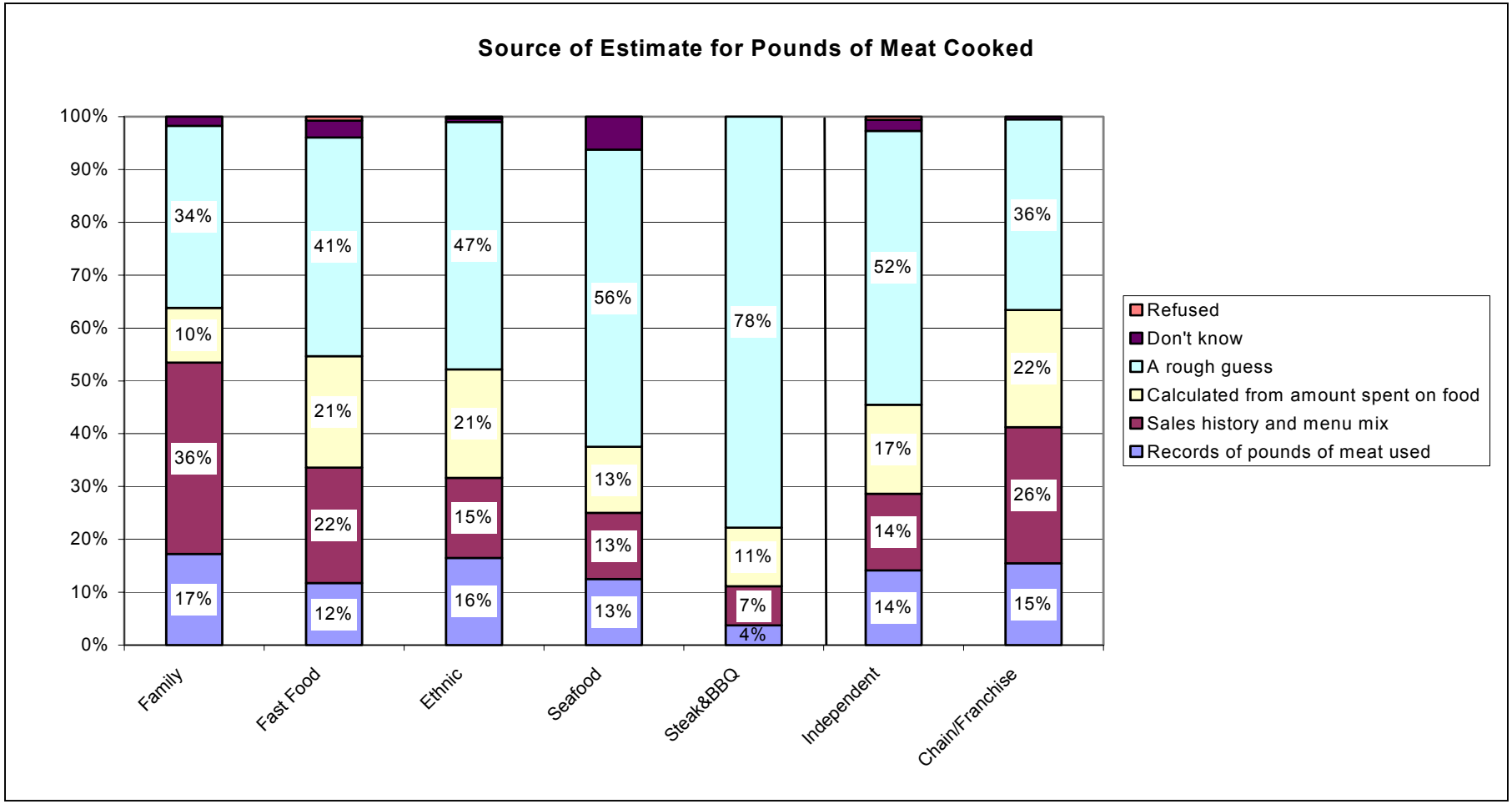

Figure 2--Source of Estimates

Amounts of Meat Cooked per Week

Table 12--Amounts of Meat Cooked per Week by Type—Survey Population

Meat Types	Sum	%
Hamburger	125,598.00	32%
Poultry, Skinless	75,846.50	20%
Steak	66,576.50	17%
Seafood	52,799.00	14%
Poultry w/Skin	37,939.00	10%
Pork	25,800.43	7%
Other meats	2,300.00	1%
TOTAL	**386,859.43**	**100%**

Hamburger was the type of meat that accounted for the largest proportion of meat cooked overall (33%) followed by Skinless Poultry (20%). (See Table 12.)

The following tables refer to the average amount of each type of meat cooked on the named equipment at each site reporting at least one piece of the listed equipment[11]. The largest average amounts of meat were cooked with chain-driven charbroilers (mean: 838 pounds; geometric mean: 297 pounds) and clamshell griddles (mean: 1,098 pounds, geometric mean: 321 pounds). Hamburger was the type of meat cooked most often on chain-driven charbroilers. Hamburger was also the type of meat cooked most on both flat and clamshell griddles. Poultry with skin and hamburger were the types of meat cooked most in deep-fat fryers. This finding is somewhat puzzling in that hamburger would not seem a likely candidate for this method of cooking. The mean for the amount of hamburger cooked weekly in deep-fat fryers is based upon the answers of only nine respondents that reported cooking this type of meat with this device. Two fast-food restaurants that serve primarily hamburgers reported cooking 1,000 pounds of hamburger in deep-fat fryers each week, while the other seven respondents reported amounts below 100 pounds. This would appear to be the result of hurried respondents misunderstanding what was being asked of them, and points out one of the difficulties inherent in collecting this information by phone. In a more extensive study, this information could be checked by re-contacting respondents for clarification.

Table 13--Average Pounds of Meat Cooked on Each Type of Equipment per Week

		95% Confidence Interval				95% Confidence Interval	
Type of Food	Mean	Lower Bound	Upper Bound	Std. Deviation	Geo-metric Mean	Lower Bound	Upper Bound
CHAIN-DRIVEN CHARBROILERS							
Steak	236.17	2.53	469.82	540.30	81.49	46.94	140.94
Hamburger	797.81	389.02	1,206.59	1,012.07	372.34	209.77	660.30
Poultry With Skin	147.14	-16.72	311.00	177.17	76.97	23.65	245.55
Poultry--Skinless	266.20	-43.66	576.05	716.54	84.35	48.06	147.53
Pork	57.63	29.85	85.40	323.43	47.17	25.04	88.15
Seafood	118.83	-58.15	295.81	278.54	44.00	21.12	90.58
Other	--	--	--	--	--	--	--
All Types of Meat	**838.44**	**419.41**	**1,257.47**	**1,344.67**	**297.06**	**173.50**	**508.10**

[11]Table 30 gives the average amounts of meat cooked per individual device.

Table 13 (continued)

		95% Confidence Interval				95% Confidence Interval	
Type of Food	Mean	Lower Bound	Upper Bound	Std. Deviation	Geo-metric Mean	Lower Bound	Upper Bound
UNDERFIRED CHARBROILERS							
Steak	180.06	133.42	226.69	319.73	86.38	73.32	101.75
Hamburger	270.17	139.98	400.36	723.30	87.27	69.21	109.97
Poultry With Skin	143.95	74.05	213.86	284.36	67.45	51.43	88.35
Poultry—Skinless	179.05	127.56	230.54	33.22	83.35	69.42	100.06
Pork	148.06	73.73	222.39	307.08	58.11	43.47	78.65
Seafood	142.62	81.64	203.60	--	64.95	52.25	80.68
Other	41.50	21.55	61.45	27.89	34.50	21.72	54.44
All Types of Meat	**488.36**	**384.64**	**592.08**	**850.95**	**167.81**	**134.89**	**208.75**
DEEP-FAT FRYERS							
Steak	181.46	63.22	299.70	292.73	69.02	40.30	117.71
Hamburger	274.44	-42.14	591.03	411.86	118.34	45.08	308.10
Poultry With Skin	364.52	197.04	532.01	665.02	103.50	70.42	151.90
Poultry--Skinless	207.76	133.31	282.20	410.09	87.63	69.89	109.79
Pork	58.55	40.07	77.04	69.04	41.94	34.22	51.35
Seafood	158.69	101.88	215.50	354.48	61.81	51.24	74.51
Other	274.00	-251.45	799.45	423.18	82.75	8.24	758.10
All Types of Meat	**238.31**	**185.18**	**291.44**	**506.08**	**42.14**	**33.13**	**53.54**
FLAT GRIDDLES							
Steak	166.02	99.10	232.95	384.18	67.39	51.19	82.62
Hamburger	362.27	221.07	503.46	729.60	111.51	83.92	149.07
Poultry With Skin	87.97	44.93	131.01	121.38	49.12	34.01	70.75
Poultry—Skinless	110.93	82.14	139.72	169.12	59.24	49.75	70.52
Pork	111.73	76.16	147.30	166.90	59.42	47.37	74.47
Seafood	92.14	59.94	124.34	141.87	50.72	40.40	63.63
Other	57.50	30.32	84.68	32.51	48.60	27.73	84.64
All Types of Meat	**322.03**	**253.46**	**390.60**	**603.52**	**76.68**	**60.02**	**97.90**

Table 13 (continued)

		95% Confidence Interval				95% Confidence Interval	
Type of Food	Mean	Lower Bound	Upper Bound	Std. Deviation	Geo-metric Mean	Lower Bound	Upper Bound
CLAMSHELL GRIDDLES							
Steak	93.33	50.70	135.96	67.09	75.33	49.10	115.33
Hamburger	1,314.33	500.63	2,128.04	1,787.60	452.31	209.77	974.00
Poultry With Skin	112.63	9.91	215.34	122.86	64.15	23.95	169.10
Poultry—Skinless	108.00	48.56	167.44	107.33	68.52	39.07	116.61
Pork	117.86	70.33	165.38	82.32	84.04	48.01	146.54
Seafood	632.14	-38.84	1,303.13	725.51	211.96	39.58	1,116.64
Other	--	--	--	--	--	--	--
All Types of Meat	**1,097.56**	**548.65**	**1,646.46**	**1,573.17**	**320.51**	**155.35**	**660.00**

The following tables refer to the average amount of each type of meat cooked by each major category of restaurant. Fast food restaurants cooked the largest average amounts of meat (mean: 1,331, geometric mean: 619). Hamburger was the type of meat cooked the most by fast food restaurants. Steak was the meat cooked most by steak and barbecue restaurants (mean: 491, geometric mean 86) and ethnic restaurants (mean 123, geometric mean 21). Poultry with skin and hamburger were the types of meat cooked most by family restaurants. Seafood was the meat cooked most by seafood restaurants (mean: 639, geometric mean: 79).

Table 14--Average Pounds of Meat Cooked by Each Restaurant Category

		95% Confidence Interval				95% Confidence Interval	
Type of Restaurant	Mean	Lower Bound	Upper Bound	Std. Deviation	Geo-metric Mean	Lower Bound	Upper Bound
ETHNIC							
Steak	122.85	86.45	159.25	315.49	21.29	16.32	27.70
Hamburger	87.12	53.13	121.10	202.65	17.79	15.57	25.00
Poultry With Skin	56.26	37.04	75.47	121.48	7.96	5.38	11.59
Poultry—Skinless	118.42	88.05	148.78	276.52	17.62	13.51	22.88
Pork	33.62	24.09	43.15	80.57	5.37	4.07	6.99
Seafood	98.81	56.09	141.53	371.54	11.76	9.02	15.26
Other	14.28	5.98	22.58	26.96	2.65	1.18	5.12
All Types of Meat	**458.68**	**374.19**	**543.16**	**732.23**	**216.37**	**187.73**	**249.35**

Table 14 (continued)

		95% Confidence Interval				95% Confidence Interval	
		Lower Bound	Upper Bound	Std. Deviation	Geo-metric	Lower Bound	Upper Bound
FAST FOOD							
Steak	172.29	63.59	280.99	417.10	25.52	13.91	46.16
Hamburger	807.82	548.04	1,067.59	1,437.15	134.18	82.79	217.12
Poultry With Skin	447.38	245.34	649.42	747.35	35.72	15.54	80.49
Poultry—Skinless	216.33	124.20	308.46	489.80	33.54	21.49	52.10
Pork	100.34	37.16	163.53	261.04	14.38	7.94	25.45
Seafood	61.77	19.83	103.72	170.63	12.75	7.74	20.64
Other	150.71	-195.71	497.13	374.57	11.22	0.43	103.57
All Types of Meat	**1,330.64**	**1,021.95**	**1,639.34**	**1,750.81**	**618.53**	**484.86**	**788.98**
FAMILY							
Steak	104.49	49.49	159.49	228.96	23.75	14.37	38.83
Hamburger	218.52	-11.56	448.61	913.58	31.11	18.45	52.03
Poultry With Skin	42.25	7.73	76.77	102.03	7.54	3.34	15.82
Poultry--Skinless	185.44	27.88	343.00	593.82	32.71	19.03	55.74
Pork	77.43	14.57	140.30	243.34	10.02	5.54	17.55
Seafood	86.47	13.46	159.47	277.64	15.85	9.47	26.11
Other	33.33	-53.91	120.57	35.12	12.01	-0.95	3,568.44
All Types of Meat	**738.43**	**306.79**	**1,170.07**	**1,641.61**	**326.47**	**243.71**	**437.22**
SEAFOOD							
Steak	117.60	29.46	205.74	123.21	54.87	15.58	187.32
Hamburger	59.00	-10.70	128.70	83.37	26.26	7.49	86.58
Poultry With Skin	21.83	-0.48	44.15	21.26	12.18	1.99	57.09
Poultry—Skinless	90.82	-21.74	203.38	167.55	17.04	3.57	70.17
Pork	52.00	-34.39	138.39	82.32	8.35	-0.19	103.23
Seafood	639.21	145.70	1,132.72	1,023.91	78.69	18.24	328.91
Other	--	--	--	--	--	--	--
All Types of Meat	**952.25**	**338.02**	**1,566.48**	**1,152.70**	**504.14**	**267.35**	**949.85**

Table 14 (continued)

		95% Confidence Interval				95% Confidence Interval	
		Lower Bound	Upper Bound	Std. Deviation	Geo-metric	Lower Bound	Upper Bound
STEAK & BBQ							
Steak	491.08	155.37	826.79	813.30	85.56	30.10	239.88
Hamburger	128.44	39.44	217.84	179.76	35.02	12.40	95.81
Poultry With Skin	138.33	51.14	225.52	191.54	24.92	7.25	80.41
Poultry—Skinless	93.88	33.70	154.05	142.50	23.72	9.50	57.18
Pork	162.28	60.66	263.89	267.15	22.40	7.83	61.03
Seafood	113.48	47.34	179.62	152.95	36.26	15.57	82.79
Other	106.00	-36.55	248.55	114.80	40.67	1.77	626.77
All Types of Meat	**1,021.96**	**512.48**	**1,531.44**	**1,287.91**	**435.74**	**239.68**	**791.54**

Days of Week and Busiest Meal Times (Weekdays and Weekends)

Respondents were asked a number of questions about the days of the week they were open, their busiest mealtimes for weekends and weekdays, the proportion of all of the week's meat they cooked on weekends in general and for their busiest weekday meal. These questions were intended to provide a framework for temporal estimations of throughput.

Days of the Week Open for Business

Eighty percent of all restaurants surveyed were open all seven days of the week. The following table represents the percent of businesses within each restaurant category that are open on the day listed. Ethnic Food restaurants are least likely to be open all seven days of the week. This category is heavily dominated by independent restaurants, which are significantly less likely to be open every day of the week than chain or franchise restaurants. Seventy percent of independent restaurants are open all days of the week vs. 97% of chain/franchise restaurants.

Table 12--Percent of Restaurants Open by Day of Week by Restaurant Type

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	All 7 Days
Ethnic	85.8%	88.4%	97.1%	97.4%	99.5%	99.7%	98.2%	72.9%
Fast Food	96.8%	99.4%	100.0%	99.4%	100.0%	99.4%	97.5%	93.6%
Family	97.1%	94.3%	97.1%	100.0%	100.0%	100.0%	100.0%	91.4%
Seafood	89.5%	94.7%	100.0%	100.0%	100.0%	100.0%	100.0%	84.2%
Steak & BBQ	86.2%	79.3%	89.7%	100.0%	100.0%	100.0%	100.0%	75.9%
Total	89.8%	91.5%	97.6%	98.3%	99.7%	99.7%	98.3%	80.3%

Proportion of Week's Meat Cooked on Weekends

Respondents were provided a calculation of the total number of pounds of meat that they had reported cooking in a typical week on the five types of equipment listed (underfired and chain-driven charbroilers, deep-fat fryers, flat and clamshell griddles.) They were then asked how many of those pounds of meat were cooked on weekends. This question proved to be very difficult for many respondents. It had been assumed that it would be easier for respondents to report the number of pounds they cooked on the weekend rather than the proportion of meat they cooked on the weekends. Some respondents gave a number for the weekend amount that was greater than the total for the entire week. It is possible that they were reporting pounds of meat for equipment types *not listed* in the survey. Proportions that were greater than .95 were eliminated from the analysis unless the respondent was open only on the weekends (n=1).

Weekends accounted for a disproportionate amount of the meat cooked on the named devices (See Table 15 below.) Fast food restaurants seemed to cook a significantly smaller proportion of meat on the weekends than other restaurants, while family restaurants seemed to cook a significantly larger proportion of meat on the weekends than other restaurants.

Table 15--Proportion of Meat Cooked on Weekends by Restaurant Type

Proportion of Meat Cooked on Weekends		95% Confidence Interval			
Category	Mean	Lower Bound	Upper Bound	Median	Std. Deviation
All Restaurants	.4286	.4132	.4440	.4543	.1763
Fast Food Restaurant	.3932	.3626	.4239	.4000	.1718
Family Restaurant	.4923	.4474	.5372	.5058	.1660

Busiest Weekend Meals

Restaurants were asked to identify the meal for which they cooked the most meat during the weekend, with "weekend" being defined as including Friday night, all day Saturday and all day Sunday. It was assumed that weekend cooking would be more variable than weekday cooking.

The peak weekend meal for most restaurants was Friday dinner, followed by Saturday dinner. Saturday dinner was the busiest meal for the majority (62%) of steak and barbecue restaurants. Saturday lunch was also an important meal for fast food restaurants. While Saturday dinner was the busiest meal for 35% of fast food restaurants, 28% of fast food restaurants chose Saturday *lunch* as the busiest meal. Only family restaurants frequently chose breakfast as the busiest meal, with 26% of family restaurants choosing either Saturday or Sunday breakfast as their busiest meal.

Table 16 --Busiest Weekend Meal

	N	Percent
None of the above	52	7.9%
Friday Dinner	270	41.2%
Saturday Breakfast	14	2.1%
Saturday Brunch	4	.6%
Saturday Lunch	81	12.4%
Saturday Dinner	167	25.5%
Sunday Breakfast	20	3.1%
Sunday Brunch	4	.6%
Sunday Lunch	26	4.0%
Sunday Dinner	15	2.3%
Don't Know	2	.3%
Total	655	100.0%

Busiest Weekday Meals

Restaurants were also asked to identify the *weekday* meal for which they cooked the most meat. While dinner (45%) was the most frequently chosen meal, lunch was a close second at 38%. While dinner was the most frequently chosen category for most restaurant types, 60% of fast food restaurants chose lunch as the busiest meal on weekdays. In contrast, 76% of steak and barbecue restaurants chose dinner as their busiest meal. Only family restaurants frequently chose breakfast as their busiest weekday meal—about 17% did so.

Table 17--Busiest Weekday Meal

	N	Percent
Breakfast	28	4.3%
Lunch	246	37.6%
Dinner	292	44.6%
Varies	80	12.2%
Don't know	7	1.1%
refused	1	.2%
Total	654	100.0%

Proportion of Meat Cooked for Busiest Weekday Meal

Respondents were asked to identify what percent of the day's meat was cooked for that busiest weekday meal. This variable was intended to provide a rough measure of the amount of the day's meat cooked for the busiest weekday meal so that estimates of throughput by day and time of day could be calculated. Respondents were only asked whether the proportion of the day's meat cooked for that meal was less than half, about half, or more than half, of all of the day's meat. (It would be more accurate to ask respondents for exact proportions or percentages, but some researchers believe that it is best to avoid questions that ask respondents to calculate percentages and/or proportions.) Nonetheless, respondents generally found this question difficult to answer.

Temporal Calculations

It was difficult to ask detailed temporal questions of respondents. The complexity of the questions seemed to confuse many respondents and added to the length of the survey. The information about time of week, time of day and amounts by time of week and time of day can be used for rough temporal-based estimations of throughput. However, further refinement is needed to hone these types of questions to provide a clearer picture of throughput by time of day and time of week.

The amount of meat cooked during the week could be obtained by subtracting the amount of meat cooked on the weekend (Q80) from the total amount of meat calculated from all questions about pounds of meat (Q77). It was assumed that weekday cooking would be less variable in volume than weekend cooking—in other words, it would be easier for restaurants to identify a meal that was generally the busiest every weekday. It would then be possible to arrive at a rough estimate of the pounds of meat cooked during lunch, breakfast and dinner every weekday. The amount of meat cooked during the week could then be divided by the number of weekdays (all meals Monday through Thursday and breakfast and lunch on Fridays).

Overall, calculations based on the information from those respondents that *could* provide quantitative estimates suggests that although more restaurants chose dinner as their busiest weekday meal, weekday lunch might actually account for an equal or greater *amount* of cooked meat. **About 3% of meat was cooked at breakfast, 45% at lunch and 41% at dinner, and 11% could not be assigned a time.** This is at least partially due to the fact that lunch is the busiest weekday meal for most fast food restaurants, the restaurant type responsible for the largest overall average amount of meat cooked during a typical week.

Calculations--Number of pounds of meat cooked on weekdays by time of day

It is possible to work out a very rough estimation of throughput for weekday meals as follows:

- Let Q77 = Total pounds of meat cooked on listed equipment
- Let Q80 = Total pounds of meat cooked on listed equipment cooked on weekends
- Let Q83a = 36% if "less than half of day's meat", 50% if "about half of day's meat, 75% if "more than half of day's meat"

A. (Q77-Q80) * (Q83a) = Weekly amount of meat cooked during busiest meal
B. (Q77-Q80) * (1-Q83a) = Weekly amount of meat cooked during times other than busiest meal.

It is then possible to determine roughly how many pounds of meat per week are cooked for the busiest weekday meals by meal, and for the less busy meals overall. The approximate proportions were determined as follows:

1) Determine the weekly total pounds for breakfast, lunch and dinner if the meal is the day's busiest meal for that restaurant. (See A. above.)
2) Determine the weekly total pounds for "not breakfast" (lunch & dinner), "not lunch" (breakfast and dinner) and "not dinner" (breakfast and lunch). (See B. above.)
3) Add to the totals for busiest weekday meals estimates for non-busiest meals. For example, to get the sums for not busiest breakfasts, multiple the pounds from category (not busiest) "breakfast & dinner" by the percent busiest breakfasts make of the sum of busiest breakfasts plus busiest dinners. Add to that the sum derived by multiplying the category not busiest "breakfast & lunch" by the percent busiest breakfasts make of the sum of busiest breakfasts and lunches.
4) Finally, treatment of the 12% of cases in which respondents reported that their busiest meal "varied" could be handled in one of two ways. Either "varied" could be kept out as a separate category, or the amount of pounds reported for this category could be allocated to the other categories in roughly the same proportions that each of the busiest meals made of the total of pounds for all busiest meals (3% to breakfast, 55% to lunch, and 42% to dinner). **If the latter calculation is used, about 3% of meat was cooked at breakfast, 51% at lunch and 46% at dinner during the week.**

Calculations--Number of pounds of meat cooked on weekends by time of day

While survey questions *did* allow estimation of the amount of meat cooked on the weekend and identification of the busiest meal by day, they did not allow assignment of pounds or proportions to that meal.

Numbers of Employees and Numbers of Customers Served

Respondents were asked how many customers their restaurant served in a typical week. Information about the number of employees at the restaurant site was provided by Dun & Bradstreet as part of the sample database and was not verified with the respondent.

Number of Customers Served

The average number of customers served in a typical week was 1,703 customers, while the median was 1,000. Chain restaurants served significantly more customers on average in a typical week than did independent restaurants (2,786 vs. 978 customers.) Ethnic food restaurants, a category dominated by independent restaurants, had the lowest average number of customers (1,195) while fast food and family restaurants had the highest average numbers of customers (2,577 and 2,412 respectively.)

Table 18--Number of Customers Served by Restaurant Type

Customers Served		95% Confidence Interval			
Category	Mean	Lower Bound	Upper Bound	Median	Std. Deviation
Raw Mean					
All Restaurants	1,702.82	1,548.12	1,857.12	1,000.00	1,776.53
Independent Restaurants	978.37	852.53	1,104.22	600.00	1,116.85
Chain/Franchise Restaurants	2,785.94	2,597.69	3,064.18	2,200.00	2,015.57
Ethnic	1,194.75	1,038.49	1,351.01	700.00	1,370.68
Fast Food	2,577.01	2,170.21	2,983.81	1,800.00	2,202.16
Family	2,412.40	1,920.10	2,904.70	1,900.00	1,905.70
Seafood	1,891.25	1,069.15	2,713.35	1,425.00	1,542.81
Steak & BBQ	1,967.00	1,242.94	2,691.06	1,300.00	1,547.10
Geometric Mean					
All Restaurants	995.84	905.65	1,095.00		
Independent Restaurants	626.88	564.53	696.11		
Chain/Franchise Restaurants	1,988.12	1,747.26	2,263.12		
Ethnic	729.47	651.53	816.71		
Fast Food	1,592.68	1,294.69	1,958.75		
Family	1,614.10	1,237.80	2,104.72		
Seafood	1,249.26	696.91	2,238.75		
Steak & BBQ	1,352.32	857.22	2,133.52		

Number of Employees on Site

The average number of employees per restaurant was twenty-three while the median was 15 employees. The range was from one to 180 employees. Again, chain restaurants employed significantly more individuals per site than did independent restaurants (35 employees vs. 16 employees.) Seafood restaurants had the lowest average number of employees (15), while steak and barbecue and family restaurants had the highest average numbers of employees (38 and 34 respectively.)

Table 19–Average Number of Employees by Restaurant Type

Restaurant Employees		95% Confidence Interval			
Category	Mean	Lower Bound	Upper Bound	Median	Std. Deviation
All Restaurants	23.08	21.17	24.99	15.00	24.51
Independent Restaurants	15.86	13.94	17.78	9.50	19.40
Chain/Franchise Restaurants	34.98	31.50	38.46	29.00	27.30
Ethnic	18.45	15.92	20.98	10.00	24.54
Fast Food	25.32	22.68	27.97	24.00	16.47
Family	34.12	28.61	39.62	32.00	22.90
Seafood	31.84	14.77	48.92	25.00	35.42
Steak & BBQ	37.66	23.85	51.46	21.00	36.30
Geometric Mean					
All Restaurants	14.49	13.36	15.70		
Independent Restaurants	9.88	8.94	10.90		
Chain/Franchise Restaurants	26.74	24.18	29.56		
Ethnic	10.71	9.61	11.93		
Fast Food	19.76	17.34	22.50		
Family	26.00	21.12	31.97		
Seafood	19.74	11.57	33.24		
Steak & BBQ	24.12	16.13	35.85		

Restaurants with at least one charbroiler had significantly higher sales volumes and more employees than did restaurants without charbroilers. However, these restaurants did not seem to differ from other restaurants in terms of the average number of customers served per week.

Table 20--Comparison: Sales Volume, Number of Employees, Number of Customers by Whether or Not Restaurant Uses Charbroiler

		95% Confidence Interval			
Category	Mean	Lower Bound	Upper Bound	Median	Std. Deviation
SALES VOLUME					
Restaurants with Charbroilers	683,862.20	550,867.43	816,856.97	400,000.00	1,045,893.18
Restaurants with no Charbroilers	466,149.56	373,194.11	559,105.02	230,000.00	673,356.38
EMPLOYEES					
Restaurants with Charbroilers	26.31	23.42	29.19	20.00	26.82
Restaurants with no Charbroilers	19.36	16.92	21.80	12.00	21.18
CUSTOMERS					
Restaurants with Charbroilers	1,617.01	1,423.44	1,810.58	900.00	1,633.55
Restaurants with no Charbroilers	1,825.07	1,571.11	2,079.02	1,000.00	1,946.08
Geometric Mean					
SALES VOLUME					
Restaurants with Charbroilers	384,243.80	334,692.29	441,132.45		
Restaurants with no Charbroilers	258,760.70	224,139.33	298,667.36		
EMPLOYEES					
Restaurants with Charbroilers	16.75	14.99	18.71		
Restaurants with no Charbroilers	12.21	10.85	13.72		
CUSTOMERS					
Restaurants with Charbroilers	992.34	878.22	1,121.54		
Restaurants with no Charbroilers	1,008.49	866.56	1,173.36		

Respondents' Knowledge About the Connection Between Commercial Cooking and Air Quality

At the end of the survey, respondents were asked a series of questions to ascertain their level of knowledge about the impact of commercial cooking on air quality and to determine whether they had heard any information about possible regulation of cooking practices. They were asked, "Have you ever heard anything connecting commercial cooking and air quality?" In general, respondents were uninformed about the possible impact of different cooking practices on air quality.

Table 21--Respondents' Knowledge About the Connection Between Cooking & Air Quality

	N	Percent
yes	108	16.5%
no	533	81.4%
don't know	13	2.0%
refused	1	.2%
Total	655	100.0%

Only 17% of the respondents claimed to have heard of any connection between commercial cooking and air quality. (See Table 21.)

What Information Did Respondents Receive?

If respondents answered affirmatively to this question, they were asked to identify what they had heard about the connection between cooking and air quality, and what was the source of the information. A large number of respondents, about 20%, misunderstood the question, reporting only the source of the information rather than the message they had received about the issue[12]. Another large group of respondents, another 20%, had heard about a connection, but could not remember what they had heard.

Table 22--What Respondents Have Heard About the Issue

	N	Percent
Irrelevant answer, did not understand question	21	19.8%
Cannot remember what s/he heard	21	19.8%
Cooking may contribute to air pollution	14	13.2%
Charbroilers or deep-fat fryers in particular are a problem	6	5.7%
They need to have filters, vents, scrubbers, hoods or other exhaust systems	29	27.4%
They heard something about wood smoke and air pollution	4	3.8%
They heard about government regulations or potential regulation	7	6.6%
They heard that smoke is a problem (unspecified)	5	4.7%
Other, nuisance or health effects	6	5.7%
Total responses	106	106.6%

Table 22 above summarizes what in general these respondents had heard about the connection between commercial cooking and air quality. The plurality of respondents (27%) mentioned something about the need for special exhaust equipment (filters, vents, scrubbers, hoods, and other exhaust systems). Only 13% of the respondents mentioned an explicit connection between commercial cooking and air pollution. A small number (6%) mentioned a specific type of cooking equipment as being problematic. Charbroilers

[12] As will be discussed later in this report, the ability of survey interviewers to probe is of paramount importance in this type of study.

were mentioned in almost all of these cases, although one respondent thought that deep-fat fryers also represent a threat to air quality. It was somewhat unclear whether many respondents were referring to concerns about indoor air quality and workplace safety, or whether they were referring to the broader issue of air pollution.

From What Source Did Respondents Receive Their Information?

Table 23--Sources of Information

Media Source	Frequency	Percent
Gov. or Advocacy Group	21	19.8%
magazine	14	13.2%
newspaper	11	10.4%
TV	11	10.4%
can't remember	9	8.5%
permits	6	5.7%
training	6	5.7%
brochure	5	4.7%
colleagues	5	4.7%
corporate management	5	4.7%
experience	5	4.7%
media (unspecified)	5	4.7%
convention	4	3.8%
inspection	4	3.8%
radio	4	3.8%
vendors	3	2.8%
conversation	2	1.9%
newsletter	2	1.9%
repair person	2	1.9%
city codes	1	0.9%
customers	1	0.9%
landlord	1	0.9%
Total	106	119.8%

The media was the most common source of information on the connection between cooking and air quality for respondents (44.4%). .Government agencies or advocacy groups including the Air Quality Management District, the Restaurant Association, and the EPA were the second most common source of information.

What Variables Affect Respondents' Level of Knowledge About This Issue?

While a slightly larger percentage of respondents in the South Coast Air Quality Management District than respondents in the rest of the state (20% vs. 15%) had heard of a connection between commercial cooking and air quality, the difference was not statistically significant at the .05 level. Due to the history of this issue in the SCAQMD, we would have expected greater knowledge of the issue in the South Coast area.

What did seem to impact respondents' knowledge of the issue was whether or not they owned a chain-driven charbroiler. Respondents with at least one chain-driven charbroiler were significantly more likely than respondents without this type of equipment to claim that they had heard of a connection between cooking and air quality. Twenty-nine percent of respondents with chain-driven charbroilers had heard of the connection compared to 16% of respondents without such equipment. Respondents with at least one chain-driven charbroiler were also more likely to say that they had heard about the necessity of installing some special type of exhaust equipment. The South Coast Air Quality Management District has been requiring the installation of catalysts for this equipment since November of 1997.

Possession of an underfired charbroiler, a type of equipment not yet regulated, or any other type of cooking equipment, did not seem to impact knowledge about the issue. Restaurant ownership (chain/franchise vs. independent) did not seem to be related to the likelihood that a respondent would know of a connection between cooking and air quality.

Table 24 –Respondents' Knowledge About the Issue by Whether or Not the Restaurant has a Chain-Driven Charbroiler

		Have you ever heard anything connecting commercial cooking and air quality?				Total	
		yes		no			
		Frequency	Percent	Frequency	Percent	Frequency	Percent
Chain-Driven Charbroiler	None	92	15.8%	489	84.2%	581	100.0%
	1 or more	15	29.4%	36	70.6%	51	100.0%
Total		107	16.9%	525	83.1%	632	100.0%

Estimation of Statewide Totals by Type of Meat and Cooking Method

We considered two strategies for estimating statewide total amounts of meat cooked by type of meat and cooking method. The simplest approach consists of multiplying the sample means for each type of meat by the number of restaurants in the sampling frame. This method is the most accurate for aggregated sums, but is not well suited to subdivision by region or type of restaurant.

Because of these limitations, we also calculated least squares regression models for each type of meat and cooking method, using information available from the sampling frame to predict the amount of meat cooked by sampled restaurants, and then applying the resulting model to the entire frame. Predictors estimated included the number of employees at the specific location, restaurant located in a city of population 500,000 or greater, and dummy-coded indicators of restaurant type. The restaurant types included in the model were seafood, Steak, fast food, Ethnic-Italian, Ethnic-American, Ethnic-Mexican, Ethnic-Chinese. County-based regional coding was considered in early models, but was discarded because regional information did not significantly or substantively improve the models.

A consistent problem in using least squares models to predict amounts of meat cooked is the nature of the distribution of restaurants. In all cases, distributions are highly skewed, with a small number of very large restaurants dwarfing the contributions of smaller establishments. Models based on raw reports would thus result in substantial overestimation of meat cooked. In order to improve the accuracy of prediction across individual restaurants, the measures of meat cooked were log-transformed after adding a constant of 1 to retain reported zeroes. Although transformation improves model accuracy with respect to any given restaurant, it has the opposite effect to analyses based on raw data – statewide totals in this case will be underestimated. To further illustrate this problem, Figure 1 below presents a Lorenz curve of cumulative proportion of total meat charbroiled (all types of meat) by cumulative population, based on untransformed sample data.

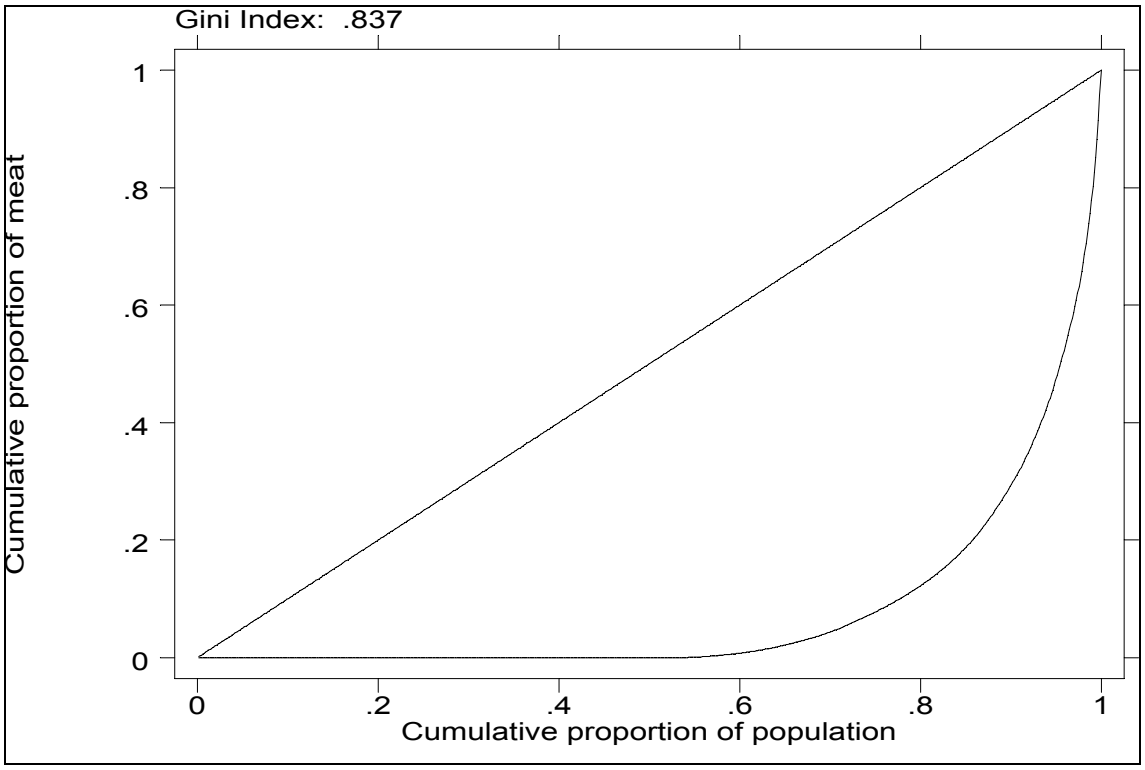

Figure 3--Lorenz curve for total charbroiled meat based on survey responses

The Gini index of concentration[13]represents the proportion of area below the diagonal line that is marked by the Lorenz curve. In this case, the curve and Gini index show a very high level of concentration. The highest-producing 10 percent of restaurants account for 61% of the total meat reported charbroiled in the sample, and the highest-producing 20 percent of restaurants account for 92% of the total. For comparison, Figure 2 (below) presents equivalent concentration results based on model projections (antilog of regression estimates). The transformation results in a far less concentrated distribution, but the improvements in model fit come at the expense of accurate representation of the underlying distribution. For this reason, we recommend caution when interpreting the regression-based estimates, which are best regarded as *minimum* amounts of each type of meat cooked by the different methods. Model-based estimation would be best accomplished with more sophisticated methods that take into account this underlying distribution rather than attempting to compensate by minimizing the influence of the most important data points. Unfortunately the pursuit of such methods is beyond the scope of the current report. However, the model-based estimates do capture some of the variability across restaurant types and may be preferable in some analyses for this reason.

[13] Shyrock, H.S., Siegel, J.S. et al. (1971). *The methods and Materials of Demography* (U.S. Bureau of the Census). Washington, DC: U.S. Government Printing Office.

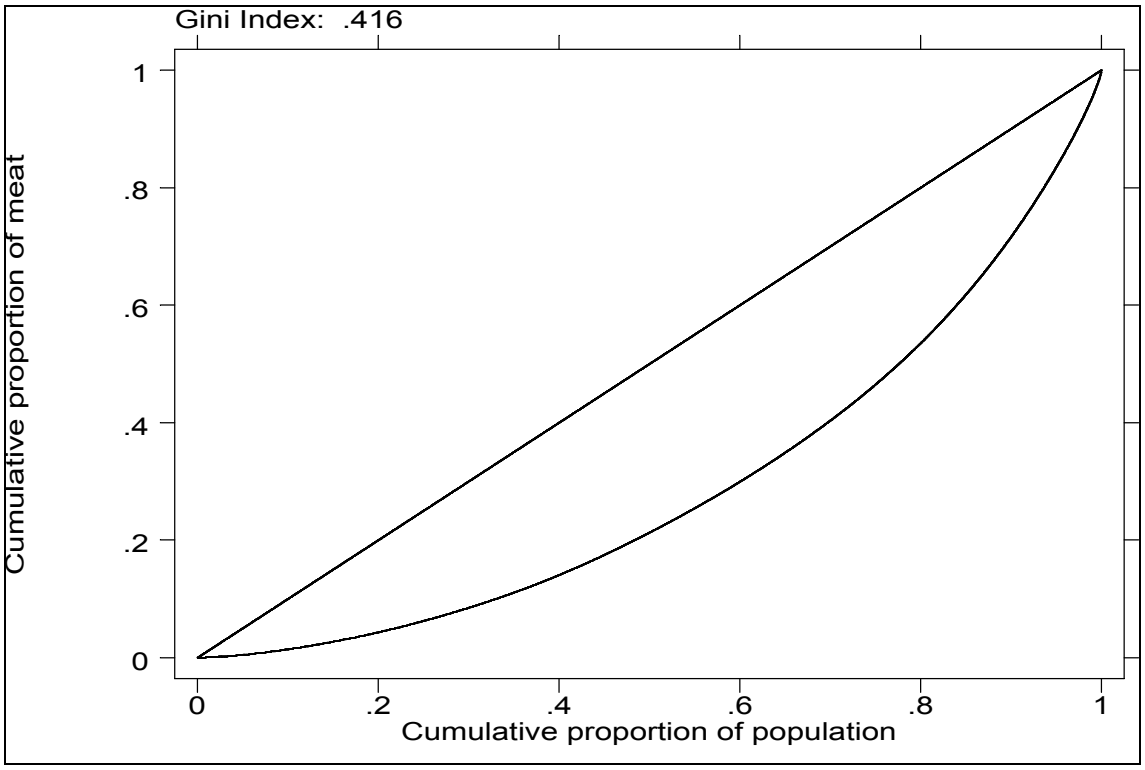

Figure 4--Lorenz curve for total charbroiled meat; model-based projection from log-transformed data

The mean and model based estimates for total meat cooked on a weekly basis by California restaurants in the selected Dun & Bradstreet categories are presented below in Table X. Chain-driven vs. underfired charbroiling methods were partitioned by multiplying the total amount of each meat type reported charbroiled by the proportions reported in the sample. As described previously, the model-based totals are much lower than those obtained from the sample means (for example, the model-based total is only 4% of the mean-based total).

Table 25--Mean and model based estimates of total pounds of meat cooked weekly by cooking method (based on 13, 741 restaurants).

Type of food	Mean-based total	Model-based total
CHAIN-DRIVEN CHARBROILERS		
Steak	113,956	34,366
Hamburger	435,160	19,141
Poultry With Skin	21,608	4,535
Poultry—Skinless	128,442	20,969
Pork	9,671	2,473
Seafood	29,916	7,269
TOTAL	738,752	88,573
UNDERFIRED CHARBROILERS		
Steak	691,256	26,204
Hamburger	685,812	6,486
Poultry With Skin	199,318	4,438
Poultry—Skinless	578,465	14,098
Pork	211,213	6,335
Seafood	299,197	8,712
TOTAL	2,665,261	66,273
DEEP-FAT FRYERS		
Steak	98,977	3,156
Hamburger	51,817	994
Poultry With Skin	481,774	10,031
Poultry—Skinless	518,655	23,676
Pork	68,789	8,368
Seafood	505,611	51,735
TOTAL	1,725,623	97,960
GRILLS AND GRIDDLES		
Steak	472,795	28,361
Hamburger	1,418,973	38,983
Poultry With Skin	79,802	3,985
Poultry—Skinless	348,140	24,830
Pork	238,536	15,624
Seafood	241,674	11,913
TOTAL	2,799,921	123,696

Regression models for each type of meat and cooking method are presented in Appendix C. Although most models explain a statistically significant share of variance in cooked meat, the amount of variance explained is generally small (e.g., $R^2 = .13$ for charbroiled steak, $R^2 = .12$ for Fried pork, $R^2 = .04$ for grilled poultry without skin). Models including additional questionnaire-based data are included at the end of Appendix X. The addition of information regarding independent vs. chain status, the number of charbroilers (if any), degree of time open on weekends, customers per week, and amount of cooking equipment provides much more explanatory gain, resulting in R^2 of .65 for total charbroiled meat, and .34 each for deep fat fried meat and grilled meat.

Discussion

Because the Pacific Environmental Services (PES) survey served as a model for the survey part of this study, much of the following discussion will focus on a comparison between the PES and the Public Research Institute (PRI) methodology and findings.

Response Rate

The response rate for this survey was higher than expected (41%). An earlier, similar survey conducted by Booz-Allen & Hamilton, Inc. in 1995 achieved a response rate of 5.3%. The Pacific Environmental Services (PES) survey conducted for the South Coast Air Quality Management District achieved a response rate of 12.9%. This may be due to the different modes of data collection. The PES and Booz-Allen surveys utilized self-administered mail surveys with phone follow-up, while the current study relied upon computer-assisted telephone interviewing (CATI) for data collection.

Data Collection Methods

The high response rate to the current study may have resulted in more representative data. This is one of the advantages to conducting a telephone survey in which repeated attempts are made to contact hard-to-reach respondents. Data collection by live interviewers as opposed to data collected via self-administered surveys can, theoretically, also be of high quality since trained interviewers guide the respondent through the survey questionnaire. This method should cut down on respondent error and diminish or eliminate item non-response, which is common in mail surveys. However, there are some important limitations to phone surveys. Respondents may be more hurried and give less accurate data when confronted by a surprise phone survey. Self-administered surveys allow respondents to sit down with the survey instrument and work out the answers to the questions at their leisure. Respondents to phone surveys must be repeatedly reminded of the time frame for which they are being asked to estimate and of the unit of analysis they are being asked to use since they cannot look at a series of questions to prompt themselves. Skillful interviewers should be able to assist the respondent by reminding them of units of analysis, probing for accurate information, and questioning answers that seem less than plausible. This requires careful training of interviewing staff.

Data Vendor Selection and Restaurant Classification

PRI paid careful attention to recommendations from the PES study in designing the survey section of this study. PRI chose to use a different sample vendor due to the recommendations of the PES researchers, who had difficulty using the restaurant classifications from ABI for stratified sampling. The PES researchers found the American Business Information categorization scheme too broad and vague—almost 75% of all restaurants were categorized as generic “restaurants”. PRI investigated the restaurant classification schemes of several different data vendors in coming to a decision. The Dun & Bradstreet database was chosen because the breakdown of restaurant categories seemed more detailed and careful than that used by other vendors. This choice was validated by survey results in at least one respect: only 7.7% of

respondents surveyed indicated that the Dun & Bradstreet category assigned to them was not the one they would have chosen to describe their restaurant. In regression analyses restaurant categories were, in many cases, statistically significant if not strong predictors of throughput. However, as Rogozan notes in the PES report, it is difficult if not impossible to assign restaurants into clearly definable and mutually exclusive categories. Dun & Bradstreet assigned up to six different categories for each restaurant. These assignments were often inconsistent: for instance, Taco Bell restaurants were alternately defined as either primarily fast food establishments, or as primarily ethnic food restaurants. Some re-categorization of primary restaurant types was necessary to achieve consistency within large chains for the purpose of stratified sampling.

Sampling

The PRI study also used a different sampling strategy than did the PES/ SCAQMD study. The PRI sample was targeted at certain types of restaurants thought to conduct more charbroiling activities rather than all restaurant types. While the PES study used a stratified random sample of a population of all restaurants in the SCAQMD, the PRI used a stratified random sample of a subset of restaurants statewide. Therefore it is not surprising that the PRI study found larger proportions of restaurants with at least one charbroiler (53% vs. 37%). The PRI study also found a greater proportion of restaurants with deep-fat fryers. This is probably due to the large proportion of fast food restaurants in the sample. However, the PRI study did not attempt to inventory the total number of all types of restaurants in the state of California, nor does it attempt to generate throughput estimates to every restaurant type as the PES study did for the South Coast Air Quality Management District. The PRI study was intended to test methodology and establish a baseline minimum amount of throughput statewide for restaurant types thought to be most likely to utilize charbroiling equipment.

The PES/SCAQMD study was not able to collect data from five national chains that were part of its sample[14]. The PES researchers tried to contact the headquarters locations of these chains rather than surveying the individual restaurants and received no response. Because of the experience of the prior researchers, PRI decided to attempt to survey all restaurants directly rather than making initial attempts with chain headquarters. A large number of national chains (246), both “fast-food” and “sit-down” restaurants, completed the survey. It is primarily these respondents that are responsible for some of the skew encountered in the data. McDonald’s, Burger King, Jack In the Box, and Wendy’s cooked on average over 1,400 pounds of meat per week compared to the overall average of 590 pounds per restaurant.

Cooking Equipment Use

The following table represents the estimated proportion of restaurants having each type of cooking equipment with 95% confidence limits. Information from the PES study is provided for comparison. The PRI study found significantly higher proportions of restaurants having each type of equipment except for Clamshell Griddles. This is partially due to the nature of the sample, which focused on restaurants likely to use charbroilers. Note that while the PES survey asked respondents about Ovens, Pit Barbecues and Ranges, the PRI survey did not.

[14] The SCAQMD survey does not mention the identity of the five national chains that did not respond.

Table 26--Proportion of Restaurants with Each Equipment Type, PRI & PES Findings

	PRI	PES
Chain-Driven Charbroilers	0.08 (0.06-0.10)	0.04 (0.02-0.05)
Underfired Charbroilers	0.45 (0.42-0.49)	0.33 (0.29-0.37)
Deep-Fat Fryers	0.87 (0.85-0.90)	0.62 (0.58-0.69)
Flat Griddles	0.63 (0.59-0.66)	0.52 (0.48-0.56)
Clamshell Griddles	0.63 (0.04-0.08)	0.06 (0.04-0.08)

The PRI study found higher a higher average number of pieces of equipment per restaurant for each equipment type than did the PES study.

Table 27--Average Number of Pieces of Equipment per Restaurant, For Restaurants Having at Least One Device of a Given Type, PRI & PES Findings

	Charbroiler	Chain-driven Charbroiler	Under-fired Charbroiler	Deep-fat Fryer	Griddle	Flat Griddle	Clamshell Griddle
ARB/PRI	**1.47**	**1.29**	**1.50**	**2.16**	**1.78**	**1.76**	**1.95**
SCAQMD/PES	--	1.00	1.35	1.48	--	1.26	1.17

The total numbers of estimated devices for the 29,054 restaurants in the PES study of the South Coast Air Quality Management District is relatively close to the total numbers of estimated devices in the PRI study of a subsample of 13,741 restaurants statewide.

Table 28--Total estimated numbers of devices, PRI & PES Findings

Study	Chain-Driven Charbroiler	Underfired Charbroiler	Deep-Fat Fryer	Clamshell Griddle	Flat Griddle	*Population*
PRI	1,411	9,085	25,942	1,787	12,981	Statewide for selected categories
PES	1,083	13,292	27,155	1,951	19,416	SCAQMD, all categories

One area that might need clarification is the wording used in both questionnaires for griddles or "grill tops". The PES survey asks respondents about "Flat or grooved grill tops" The PRI survey asks about "flat or clamshell" griddles or grill tops and alternately "flat or clamshell griddles or grills." Some respondents to the PRI survey were confused by the word "grill"—which they seemed to associate with charbroilers or open-fire barbecues.

Cooking Device Energy Sources

The PRI study's findings on the reported energy sources for cooking devices were similar to those of the PES/SCAQMD study, except that respondents to the PRI study were less likely to report electricity (and more likely to report natural gas) as the fuel source for their clamshell griddles.

Table 29--Energy Sources for Cooking Equipment, PES and PRI Findings

	PRI Gas	**PES Gas**	PRI Electricity	**PES Electricity**
Underfired charbroiler	90.1%	94.2%	3.1%	**5.0%**
Chain-driven charbroiler	86.3%	98.0%	11.8%	**2.0%**
Deep-fat fryer	82.1%	85.6%	15.6%	**14.2%**
Flat griddle	86.3%	93.4%	9.0%	**6.2%**
Clamshell griddle	70.7%	52.6%	29.3%	**47.4%**

Types and Quantities of Food Cooked

Respondents were asked whether they cooked steak, hamburger, poultry with or without skin, pork, seafood or other meat. About 62% of restaurants reported cooking four or more types of meat. This is in contrast to the findings of the SCAQMD study by PES, Inc., which found that very few restaurants cooked more than 2-3 of the types of meat surveyed. The number of types of meat cooked was related to restaurant type in the PRI study: approximately 60% of fast food restaurants and 58% of seafood restaurants reported cooking three or less types of meat. A total of 86% of steak and barbecue restaurants, and 90% of family restaurants reported cooking at least four different types of meat.

Respondents to the PRI survey were asked to give the total amount of each type of meat they cooked in a typical week on a given type of device, regardless of the numbers of those devices they might have. Respondents to the PES survey were asked to give the total amount of each type of meat they cooked in a typical week in each (individual) device. It became clear from responses to the PRI pretest survey that some respondents were confused about a) the time period for which information was being asked (day or week?), b) the unit of measurement (pounds or portions?), and c) whether they were supposed to be giving information for each device, if they had several of the same, or for all of these devices totaled. This type of ambiguity required extra interviewer training in order to teach interviewers to probe respondents for additional information, and in order to encourage interviewers to emphasize the unit of time and measurement being used. It is possible that even with a self-administered survey, this type of misunderstanding can take place. Theoretically, well-trained interviewers should make a difference in ensuring that respondents understand what is being asked of them. Nonetheless, there were some values in the data that seemed unusually low for weekly totals, especially if the type of meat being cooked was the restaurant's specialty. Cases in which the total amount of meat per device type was reported to be 10 or less pounds per week were left out of the final analysis for the generation of arithmetic and geometric means. PRI also ran tables of means by type of meat and device type, by device; and by device type and restaurant type, regardless of the number of devices the restaurant possessed. These numbers per reported device, are compared with those generated by the PES study (See Table 30 below). There are many instances where the PRI and PES averages diverge a great deal. For instance, respondents to the PRI survey reported on average many fewer pounds of hamburger cooked on chain-driven charbroilers in a typical week than did PES respondents. PRI respondents reported many more pounds of hamburger cooked on clamshell griddles in a typical week than did PES respondents.

The following table should be compared with Table 13 in the Results section, which reports average pounds of meat cooked on each type of equipment per week per restaurant, regardless of the number of identical devices the restaurant might have.

Two possible error scenarios are possible. First, in the PES study, it is possible that some respondents reported the total amount of meat cooked on a given type of device, which may have resulted in a double count when multiplied by the number of pieces of equipment. In the PRI study, it is possible that respondents gave the amount of meat cooked on an individual piece of equipment, which may have resulted in an undercount when divided by the total number of pieces of equipment if the restaurant had more than one piece of this type of equipment.

Table 30--Average Pounds of Meat Cooked Per Week by Equipment Type and Per Device, For Restaurants Having at Least One Device of a Given Type, PRI & PES Findings[15]

	Chain-driven Charbroiler	Under-fired Charbroiler	Deep-fat Fryer	Flat Griddle	Clamshell Griddle
Steak					
PRI	159.8	124.8	96.3	85.7	41.5
PES	181.6	124.5	170.1	228.3	100.0
Hamburger					
PRI	669.1	199.3	112.3	218.8	613.4
PES	2093.2	149.9	93.1	89.2	17.4
Poultry with Skin					
PRI	147.1	82.6	117.8	51.8	60.1
PES	100.0	292.8	201.4	178.2	0
Poultry, No Skin					
PRI	197.5	108.1	82.1	57.4	57.9
PES	354.1	115.9	81.5	84.1	333.0
Pork					
PRI	35.5	86.8	28.8	71.0	56.9
PES	133.3	27.0	57.0	63.5	10.0
Seafood					
PRI	89.1	96.4	65.4	42.5	295.0
PES	143.4	109.1	49.3	77.2	25.0
Other Meat					
PRI	--	16.6	105.4	14.0	--
PES	--	--	--	--	--
All Types of Meat					
PRI	664.4	323.5	103.0	183.3	565.4
PES	--	--	--	--	--

Respondent Method of Estimation of Pounds of Meat Cooked Weekly

A smaller percentage of respondents to the PRI telephone survey (48%) indicated that they had used a rough guess to estimate the amount of meat they cooked in a typical week. Approximately 60% of respondents to the PES self-administered survey indicated that they had used a rough guess for their estimates. This runs against expectations that respondents answering an impromptu telephone survey would have less time and inclination to consult records. Restaurants that were independently owned were much more likely to use a rough guess as their method of estimation. In contrast to the PES

[15] Means shown are arithmetic means.

survey, the PRI survey did not find restaurants with chain-driven charbroilers to be any more or less likely than other restaurants to use guessing as a method of deriving estimates of pounds of meat cooked. However, it should be noted that many respondents said that they found the response options irrelevant and confusing. The options were:

- Records of pounds of meat used;
- Sales history and menu mix
- Calculated from amount spent on food; and
- A rough guess.

Temporal Data on Meat Cooking Activities

The PRI survey asked for different temporal information than did the PES survey. The PES survey asked respondents for the days per week and weeks per year the restaurant was in operation. The PRI survey asked respondents what days of the week the restaurant was open, what amount of meat cooked per week on the named devices was cooked on the weekends, what specific weekend meal was busiest, and what weekday meal in general was busiest. While the PES study attempted to quantify the number of days per year the restaurant was in operation, the PRI study attempted to pinpoint peak cooking periods by restaurant, and to roughly quantify the amount of throughput processed at different times of the day and week. Effective questions about temporal data were extremely difficult to conceptualize and to ask, especially considering the variability of restaurant schedules and rush hours.

While it was possible to estimate that a disproportionate amount of the meat cooked in a week was cooked on weekends (about 43%), the construction of survey questions did not allow the researchers to pinpoint the exact time and weekend day during which the greatest proportion of meat was cooked. Questions about weekday throughput allowed for slightly more targeting. Approximately half of all meat cooked during the weekdays was cooked at lunch time and another half cooked at dinner time Monday through Friday excluding Friday dinner.

Numbers of Employees and Customers

The PES survey attempted to determine whether or not the respondent qualified as a small business, which was defined as a restaurant with an annual sales volume of $500,000 or less and 10 or fewer employees. PES determined that 58% of the restaurants in the SCAQMD were small businesses. While the PRI study did not ask respondents for this information, data from the sample information from Dunn & Bradstreet indicated that approximately 52% of the restaurants in the PRI sample were small businesses. A fairly sizable proportion of restaurant records (about one-third) were missing employee number or sales volume data, however.

The PES study found that possession of chain-driven charbroilers, clamshell griddles and underfired charbroilers was associated with restaurants that were not small businesses, while possession of grill tops (griddles), ranges and pit barbecues was associated with restaurants that *are* small businesses. PRI survey data indicated that for the selected restaurant types, possession of all types of restaurant equipment mentioned in the survey (griddles, charbroilers and deep-fat fryers) was associated with restaurants that *were not* small businesses. The PRI study did not ask respondents about pit barbecues, range tops or ovens.

The PRI study asked respondents about how many customers they served each week. This variable was weakly to moderately correlated to the total amount of meat cooked on charbroilers (.281), weakly correlated to the total amount of meat cooked in deep-fat fryers (.194), and moderately to strongly correlated to the amount of meat cooked on griddles (.394). The number of customers per week was more strongly correlated to the number of pounds of hamburger (.445) and poultry without skin (.489) cooked on chain-driven charbroilers, and the number of pounds of hamburger (.412) and pork (.558) cooked on clamshell griddles.

Connection Between Cooking and Air Quality

Questions about the connection between cooking and air quality were added to the PRI questionnaire at the request of the California Restaurant Association. They were added to the end of the survey so as not to bias the answers to preceding questions. Relatively few respondents had heard of any connection between cooking and air quality (17%). This question is an important one and could use some refinement and testing to make it a stronger measure of attitudes, information sources, and understanding.

First, answers to the question indicate that some respondents were unclear about what they were being asked. Some understood the phrase "air quality" to refer to health and safety conditions in the kitchen. It is possible that different wording would help clarify the intent—for instance, "have you ever heard anything about the impact of emissions from restaurant cooking on the air we breath?" or "on our environment".

Respondents were asked what they had heard about the connection between cooking and air quality and *where* they had heard it after an initial screener—"have you ever heard anything connecting commercial cooking and air quality?" While it would still be useful to ask *what* respondents had heard as an open-ended question, further probing by interviewers would yield more useful answers. The question about the source of the information might be asked as two multiple choice questions about 1) the media from which the respondent accessed the information (TV, radio, newspapers, word of mouth), and 2) the sponsor of the message (the agency, radio station, customers, etc., if known).

Statewide Estimation

The PES study reports estimates of numbers of devices across the South Coast Air Quality Management District. It does not estimate pounds of meat cooked district-wide.

The PRI study attempted statewide estimation of devices and pounds of meat cooked for selected restaurant categories and devices. Theses estimates should be viewed as exploratory. A larger sample including all restaurant categories, careful stratification and use of a nonlinear estimation model would yield more accurate results.

Summary and Conclusions

Survey Response

- Out of a sample of 2,298 cases, a total of 2,069 were used. Of these, approximately 623 were eligible non-interviews (refusals, answering machine, respondent not available), 636 were not interviewed (over 8 attempts were made without contact, sample was not attempted, language problems), and 385 cases

were not eligible to be surveyed (fax, disconnected number, residential phone, business other than a restaurant, restaurant that did not cook meat).
- The survey sample consisted of 655 usable responses or a response rate of 41%.
- The response distribution was proportional to the distribution of the potential sample by type of restaurant.

Cooking Equipment Use

- The following table (Table 31) represents the estimated proportion of restaurants having each type of cooking equipment with 95% confidence limits and the mean number of pieces of equipment per restaurant for facilities having at least one of the named type of equipment.

Table 31--Estimated Fractions of Facilities Having Each Type of Cooking Equipment and Mean Number of Pieces of Equipment For Facilities Having at Least One, by Restaurant Type

Restaurant Category	Chain-Driven Charbroilers	Underfired Charbroilers	Deep-Fat Fryers	Flat Griddles	Clamshell Griddles
Fast Food	18.6%	30.8%	96.8%	51.9%	14.7%
Mean	1.07	1.58	3.10	1.43	2.09
Seafood	0.0%	52.6%	100.0%	36.8%	10.5%
Mean	--	1.10	2.47	--	1.50
Ethnic	3.5%	47.5%	81.9%	62.7%	4.0%
Mean	1.62	1.54	1.63	1.88	1.80
Steak & BBQ	6.9%	55.2%	82.8%	89.7%	0.0%
Mean	--	1.63	2.42	1.35	--
Family	10.1%	60.9%	91.4%	82.9%	1.4%
Mean	1.71	1.29	2.34	2.03	--
Total	**7.9%**	**45.4%**	**87.3%**	**62.7%**	**6.3%**
Mean	**1.29**	**1.50**	**2.16**	**1.76**	**1.95**

- Fast food restaurants were the most likely to have chain-driven charbroilers (19% vs. 8% overall) and clamshell griddles (15% vs. 6% overall), equipment types intended for production cooking.
- Fast food restaurants also had on average more clamshell griddles (2.09 vs. 1.95) and deep-fat fryers (3.10 vs. 2.16) on-site than did other types of restaurants[16].
- Family restaurants reported more flat griddles on average (2.03 vs. 1.76) and chain-driven charbroilers on average (1.71 vs. 1.29) than did other types of restaurants[17].

[16] Averages are for restaurants that have at least one piece of this type of equipment on site.
[17] Averages are for restaurants that have at least one piece of this type of equipment on site.

- The following table contains statewide estimates for numbers of pieces of equipment by restaurant type and overall (Table 32) for *selected restaurant categories*. Please note that this population represents approximately 31% (13,741) of restaurants in the Dun & Bradstreet database of California restaurants.

Table 32--Estimated Total Numbers of Pieces of Equipment by Restaurant Type (Statewide)

Restaurant Type	Chain Driven Charbroiler	Underfired Charbroiler	Deep Fat Fryer	Clamshell Griddle	Flat Griddle
Ethnic food restaurant	427.35	5,535.20	10,372.04	549.45	9,004.74
Fast food restaurant	722.87	1,772.20	10,983.00	1,119.29	2,704.94
Family restaurant	223.71	1,006.71	2,796.43	37.29	16.01
Seafood restaurant	0.00	295.26	1,261.58	80.53	615.52
Steak & Barbecue restaurant	36.55	475.17	1,060.00	0	639.66
Total	**1,410.49**	**9,084.55**	**2,5942.09**	**1,786.55**	**12,980.86**

Cooking Device Energy Sources

- Natural gas was by far the most commonly used type of energy source for all types of equipment (82%-90%). However, a full 30% of restaurants with clamshell griddles reported that electricity was the heat source for this type of equipment. Underfired charbroilers were the equipment type most likely to utilize other fuel sources such as wood, charcoal and propane (a total of 7%).

Types and Quantities of Foods Cooked

- About 62% of restaurants reported cooking four or more types of meat. Family restaurants and steak and barbecue restaurants cooked the most types of meat.
- The most commonly cooked type of meat was poultry without skin (80% of restaurants).
- Hamburger accounted for the largest *proportion* of meat cooked overall (33%), followed by skinless poultry (20%).
- Fast food restaurants and family restaurants were the most likely to cook hamburger. Seventy-seven percent of fast food restaurants and 90% of family restaurants cooked hamburger.
- Hamburger was the type of meat cooked most on chain-driven charbroilers (average of 798 pounds per week), on underfired charbroilers (average of 270 pounds per week), on flat griddles (362 pounds per week), and on clamshell griddles (1,314 pounds per week). Poultry with skin was the type of meat cooked most on deep-fat fryers (365 pounds per week)[18]. (See Table 13).
- Fast food restaurants cooked the largest weekly average amounts of meat (mean: 1,331). Hamburger was the type of meat cooked the most by fast food restaurants (808 pounds per week on average). Steak was the meat cooked most by steak and

[18] Averages refer to average *per restaurant* with at least on such device.

barbecue restaurants (mean: 491 pounds) and ethnic restaurants (mean: 123 pounds). Poultry without skin (means: 185 pounds) and hamburger (219 pounds) were the types of meat cooked most by family restaurants. Seafood was the meat cooked most by seafood restaurants (mean: 639 pounds). (See Table 14.)

- The following table represents the type of equipment responsible for cooking the largest weekly average amount of each type of meat (Table 33)[19].

Table 33--Equipment Type Responsible for Cooking the Largest Weekly Average Amount of Each Type of Meat—Device Means

Meat	Equipment	Mean
Steak	Chain-Driven Charbroilers	160 pounds
Hamburger	Chain-Driven Charbroilers	669 pounds
Poultry with Skin	Chain-Driven Charbroilers	147 pounds
Poultry without Skin	Chain-Driven Charbroilers	198 pounds
Pork	Underfired Charbroilers	87 pounds
Seafood	Clamshell Griddles	295 pounds

- About 48% of restaurants either did not know how they had arrived at their weekly estimates of meat cooked, or based their estimate on a rough guess. Fifty-two percent based their estimates on some sort of records.
- About half (52%) of independent restaurants based their estimates on a rough guess compared to 36% of chain or franchise restaurants.

Days of Operation and Busiest Meal Times

- Eighty percent of restaurants surveyed were open all seven days of the week. Sunday and Monday were the most common days that restaurants were closed (8-10% were closed on each of these days).
- Ethnic food restaurants (and independently operated restaurants) were the least likely to be open all seven days a week. Twenty-seven percent of ethnic food restaurants and 30% of independently operated restaurants were closed at least one day a week.
- About 43% of meat cooked on the named devices was cooked on weekends (including Friday dinner). However, this varied by restaurant type with weekends accounting for only 37% of the meat cooked by fast food restaurants, and a full 49% of meat cooked by family restaurants.
- Friday dinner was the busiest meal for 47% of restaurants, and Saturday dinner was the busiest meal for 26% of restaurants. This varied by restaurant type with Saturday lunch being the busiest meal for 28% of fast food restaurants, while 26% of family restaurants chose Saturday or Sunday breakfast as their busiest meal.
- Dinner was the busiest *weekday* meal for 45% of restaurants while lunch was the busiest meal for 38% of restaurants. However, estimates of meat cooked suggest that an equal *amount* of meat is cooked at lunch time and at dinner time (49%).

[19] Averages refer to amount cooked *per device*.

Numbers of Employees and Numbers of Customers Served

- The average number of customers served weekly was 1,703, with a median of 1,000 customers.
- Chain/franchise restaurants had on average many more customers per week than did independents (2,786 vs. 978). Ethnic food restaurants had the lowest average number of customers (1,195) while fast food and family restaurants had the highest numbers (2,577 and 2,412).
- The average number of employees per restaurant was 23, with a median of 15.
- Chain/franchise restaurants had on average many more employees than independents (35 vs. 16). Steak and barbecue and family restaurants had the most employees of any restaurant type (38 and 34 employees, respectively).
- Restaurants with at least on charbroiler on-site had higher annual average sales volume ($683,862 vs. $466,150) and more employees (26 vs. 19) than other restaurants, although no more customers on average (1,617 vs. 1,825).

Respondents' Knowledge About the Connection Between Commercial Cooking and Air Quality

- Only 17% of respondents had heard of any connection between commercial cooking and air quality.
- Of that 17%, 27% had heard that they needed some sort of special equipment (filters, vents, scrubbers) related to either stacks or exhaust systems, 20% could not remember what they had heard, and 20% could only report *where* they had heard the information rather than what they had heard.
- The most common source of information was from the media, with 27% of respondents reporting that they had heard of this connection from a magazine or newspaper and 10% from television. About 20% had received information from a government agency or advocacy group.
- Respondents with a chain-driven charbroiler were more likely to have heard of a connection than other respondents (29% vs. 16%). While those in the SCAQMD area were somewhat more likely to have heard of some connection between cooking and air quality (20% vs. 15%), the difference was not statistically significant.

Estimation of Statewide Totals by Type of Meat and Cooking Method

- We estimate that in the state of California, approximately 7.9 million pounds of meat are cooked each week by the selected restaurant types on the five types of surveyed equipment. Approximately 3.4 million pounds of meat are cooked by charbroiling each week by the selected restaurant types. The greatest proportion of this is accounted for by hamburger (33% of the total), followed by skinless poultry (20%), and steak (17%).

- The distributions of cooked meat estimates are highly skewed, with a small number of high-volume restaurants accounting for a great proportion of the meat cooked. For example, the highest 20% of restaurants reporting charbroiling activity account for more than 90% of the meat reported cooked in this way.
- Amongst the selected restaurants types, charbroilers accounted for 43% of meat cooked on the surveyed equipment types. Fifty-eight percent of steak, 43% of hamburger, 45% of poultry without skin and 42% of pork were cooked on charbroilers(Table 34).
- The majority of poultry with skin (62%) was cooked in deep-fat fryers, while the majority of hamburger (54%) was cooked on griddles (Table 34).

Table 34--Mean based estimates of total pounds of meat cooked weekly by cooking method

	Chain-Driven Charbroiler	Under-Fired Charbroiler	Deep-Fat Fryer	Clamshell Griddle	Flat Griddle	Total
Steak	113,955.90 8%	691,256.21 50%	98,977.16 7%	23,496.06 2%	449,299.23 33%	1,376,984.56 100%
Hamburger	435,159.64 17%	685,812.26 26%	51,817.21 2%	579,031.05 22%	839,942.23 32%	2,591,762.39 100%
PWS	21,607.98 3%	199,317.93 25%	481,774.15 62%	18,901.74 2%	60,900.95 8%	782,502.75 100%
PNS	128,441.64 8%	578,464.63 37%	518,654.57 33%	33,985.37 2%	314,154.92 20%	1,573,701.14 100%
Pork	9,671.15 2%	211,212.81 40%	68,788.91 13%	34,614.73 7%	203,921.27 39%	528,208.87 100%
Seafood	29,915.52 3%	299,197.16 28%	506,030.68 47%	92,830.42 9%	148,843.35 14%	1,076,817.14 100%
Total **N=13,741**	738,752.20 9%	2,665,262.79 34%	1,726,043.84 22%	782,859.74 10%	2,017,063.26 25%	7,929,981.83 100%

- The following table represents the type of equipment responsible for cooking the largest weekly total amount of each type of meat statewide for the selected sample (Table 35)[20]. Note that although chain-driven charbroilers and clamshell griddles cook very large amounts of meat on average, there are relatively few of them and they therefore do not account for that much throughput overall. Under-fired charbroilers account for the greatest amount of throughput on a weekly basis, accounting for 34% of all meat cooked in an average week. Overall, 45% of meat is cooked on either a chain-driven or under-fired charbroiler while 35% is cooked on either a flat or clamshell griddle. Interestingly, hamburger is more likely to be cooked on a flat griddle and 55% of all hamburger is cooked on some sort of griddle, although a full 43% is cooked on either under-fired or chain-driven charbroilers[21].

[20] Percent refers to the proportion of the total amount of this type of meat cooked that is cooked on this equipment type.

[21] Also note, totals and percentages refer only to the listed types of equipment, and do not include meat cooked on other devices such as range tops, ovens, and pit barbecues.

Table 35--Equipment Type Responsible for Cooking the Greatest Amount of Each Type of Meat

Meat	Equipment	Subtotal	Percent	Statewide total
Steak	Under-Fired Charbroiler	691,256.21	50%	1,376,984.56
Hamburger	Flat Griddle	839,942.23	32%	2,591,762.39
Poultry with Skin	Deep-Fat Fryer	481,774.15	62%	782,502.75
Poultry w/out Skin	Under-Fired Charbroiler	578,464.63	37%	1,573,701.14
Pork	Under-Fired Charbroiler	211,212.81	40%	528,208.87
Seafood	Deep-Fat Fryer	506,030.68	47%	1,076,817.14
Total	Under-Fired Charbroiler	2,665,262.79	34%	7,929,976.83

- The nature of the meat cooking distribution is of great importance for the methods used to derive estimates that can be used for detailed analyses. In order to be useful, multivariate analyses of meat cooking need to employ nonlinear modeling strategies.

Focus on Charbroilers

More than half of the restaurants surveyed (53%) had at least one charbroiler. Overall, we estimate that there are at least 10,495 underfired and chain-driven charbroilers statewide in restaurants of the types surveyed. Approximately 3.4 million pounds of meat were processed weekly by charbroilers statewide amongst the surveyed restaurant types. This is approximately 45% of all meat cooked in a typical week by the surveyed population on the surveyed devices. About 30% of the meat cooked on charbroilers was hamburger, and about 43% of all hamburger cooked by the surveyed population on the surveyed devices was cooked on charbroilers.

There are an estimated 1,410 chain-driven charbroilers statewide for the population surveyed. This is about 13% of all charbroilers for this population. Fast food restaurants were the most likely to own chain-driven charbroilers (19% had them vs. 8% overall). Fast food restaurants also owned the largest estimated number of chain-driven charbroilers statewide of any surveyed restaurant category (722 or 51%). However, family restaurants had the greatest average number of chain-driven charbroilers on site if they owned at least one (1.71 vs. 1.29 overall).

Chain-driven charbroilers were the type of equipment responsible for cooking the largest weekly average amount of steak, hamburger and poultry, with and without skin, per device. While chain-driven charbroilers cook very large amounts of meat on average, there are relatively few of them and they therefore do not produce that much total throughput (9%) compared to the other surveyed devices. An estimated 738,752 pounds of meat per week are processed statewide on chain-driven charbroilers at the restaurant types surveyed.

There are about 9,085 underfired charbroilers statewide amongst the restaurant types surveyed. Steak and barbecue (61%) and family restaurants (55%) were the types of restaurants most likely to have at least one underfired charbroiler. Steak and barbecue (1.63), ethnic (1.54), and fast food restaurants (1.58) were the restaurant types with the greatest average number of underfired charbroilers on-site if they owned at least one piece of such equipment. Fast food restaurants accounted for the estimated largest total number of underfired charbroilers statewide for the population surveyed (5,532 or 61%). The type of meat most cooked on underfired charbroilers was hamburger—an average of 270 pounds per week. Underfired charbroilers accounted for the greatest estimated weekly throughput of any device surveyed—34% of all meat cooked in a typical week.

Conclusions

The objectives of this project were to:

- To develop a method for estimating spatially and temporally resolved activity data for commercial meat cooking and deep-fat frying operations throughout California; and
- To collect sufficient detailed activity and source mapping data to generate a temporally and spatially specific emission inventory for commercial cooking sources in California.

Telephone surveying, supplemented by other methods of data collection, would appear to be a successful method of data gathering for this type of estimation. Indeed, survey methodology is probably the only way to gather this type of detailed data on restaurants. Further refinement of sample selection, a bigger, more inclusive sample, and enhanced survey methodology would yield more reliable results.

Two different types of estimation were attempted for generating statewide sums of meat cooked by equipment type: ordinary least squares regression, and means-based estimation. OLS regression proved difficult due to the non-normal distribution of the data and the existence of large outliers. Logarithmic transformation of the data was somewhat helpful in addressing these problems, but resulted in underestimation of meat cooked. Non-transformed data resulted in overestimation of meat cooked. Therefore, most of the estimates presented in this report are means-based. Model-based estimation would be best accomplished with more sophisticated methods that take into account this underlying distribution rather than attempting to compensate by minimizing the influence of the most important data points.

Using geocoded data points representing individual restaurants, it is possible to map the density of meat cooking activities statewide by applying means-based estimates.

Recommendations

- In order to get a full picture of charbroiling activity in the state, any future survey should include all restaurant categories rather than a selection. While restaurants in some categories may be unlikely to utilize charbroilers, this needs to be tested empirically. In the aggregate, these restaurants may contribute substantially to the amount of throughput although individually they may contribute little.
- A bigger sample size with more detailed stratification would yield more useful data. For instance, it may not be advisable to lump together all ethnic restaurants in one category.
- Nonlinear estimation should be used to account for the skewed distribution of amounts of meat cooked. Large national chains account for a full 60% of all meat charbroiled despite the fact that they were only 34% of the restaurants using charbroilers. The large amounts of meat cooked by these restaurants skew the averages used for estimation. Sampling and analysis might take into account restaurant ownership (independent vs. chain/franchise) as well as menu category. Restaurant ownership is not included in the dataset as provided by the vendor, but large national chains are readily recognized and easily coded.

- The vendor database used for sampling should be chosen with care. The Dunn and Bradstreet database used for this study was relatively good in terms of detailed and logical categorization of restaurant types. The American Business Information data is not broken down into categories that make sense for stratification purposes. However, the Dunn & Bradstreet database still requires considerable care and cleaning in order to make sure that restaurants are categorized in a way that makes sense. For instance, a major national chain like Taco Bell should not be occasionally categorized as a fast food restaurant, occasionally categorized as an ethnic restaurant, and occasionally categorized as a family restaurant.
- Phone surveying would appear to be a successful data collection strategy for this type of study. Phone surveys can achieve significantly higher response rates than mail surveys and therefore more representative data. Low response rates are typical of business surveys utilizing a mailed questionnaire, with response rates hovering between 3% and 15%. However, phone surveying is more costly and requires that interviewers be capable of utilizing a higher level of judgment than is necessary for many simple surveys. A substantial investment up front in interviewer training would yield optimal results. A mixed method survey including both a mailed questionnaire and phone survey of non-respondents might maximize response rate and data validity.
- Other methods of data collection should be investigated and used to triangulate the findings of the survey. Industry groups and outside consultants suggested contacting groups that design restaurants and sell restaurant equipment as well as groups that sell restaurant food and interviews with representatives from the corporate headquarters of large chains. Finally, site visits with willing respondents would help clarify how data on throughput are tracked.
- Further experimentation with questionnaire construction is needed to get at different ways that businesses might quantify portions of meat. "Pounds" were used as the unit of analysis for this study because industry experts indicated that most restaurants would be able to give totals in this unit. However, there were some respondents who could only answer in terms of portions, which necessitated extensive research on the part of researchers to determine, for instance, how much the typical fish stick might weigh. A branching question could be inserted into the survey questionnaire with the appropriate types of meat asking whether respondents could quantify their throughput by pound, or some other measure. If the respondent could not answer using pounds, the respondent might be able to specify a unit(s) and then give numbers of portions for that unit.
- Further experimentation with questionnaire construction is needed to get at different ways of conceptualizing and clarifying the way that totals are requested. Some tests of how respondents understand whether they are being asked to give pounds per device vs. pounds per equipment type or cooking method could be useful.
- Temporal questions should be reworked in the future. It is important to balance the need to keep the survey short with the need to achieve more targeted temporal data. Respondents could be asked what percent of all of the (week)day's meat is

made up by breakfast, by lunch, and by dinner. Respondents might also be asked how many pounds of meat overall they cook at the busiest weekend meal.

- CATI survey questionnaires for this sort of survey need to be programmed to utilize more numeric checks throughout the course of the interview to prompt interviewers to correct or clarify implausible answers. For instance, interviewers may need to be given periodic totals throughout the survey questionnaire ("That's a total of 29 pounds of meat per week cooked on your underfired charbroiler—is that correct?") This allows them to check with the respondent before they have proceeded too far through the interview to efficiently back-up through the survey instrument and correct mistakes.
- It would be helpful to translate the questionnaire into Spanish and Cantonese. Thirty-seven percent of those who could not complete the questionnaire due to inability to speak English were Spanish speakers, and 41% were Cantonese or Mandarin speakers. A total of 116 restaurants were not surveyed due to language barriers.

Appendices

Appendix A—Questionnaire

Questionnaire name: BROIL 01/30/01 - 01:03 PM Page 1

(The following represents an edited script from the WinQuery assisted interviewing system.)

Hello, my name is [Interviewer Name] and I'm calling from San Francisco State University. We're conducting a 5-minute survey for the California Air Resources Board. The purpose of the study is to gather accurate information about the cooking practices of California restaurants. The California Restaurant Association has reviewed our survey and encourages your participation. The survey is completely confidential. Can I count on your help?

```
  GO TO Q. #13  ====>  <1> YES
 DISP CODE #9   ====>  <2> SCHEDULE CALLBACK
  GO TO Q. #4   ====>  <3> INITIAL REFUSAL
 DISP CODE #13  ====>  <4> HANG UP/HARD REFUSAL
 DISP CODE #10  ====>  <5> CALL SUBSTITUTE NUMBER
 DISP CODE #3   ====>  <6> ALREADY COMPLETED INTERVIEW
```

[There are a number of skips here so that the interviewer identify the right person at the restaurant to survey, preferably the named owner or manager, or schedule a callback at another time or date.]

*** QUESTION #13 ***

Do you cook meat at your restaurant? By meat I mean beef, chicken and other poultry, pork, seafood, etc.

.

NOTE TO INTERVIEWERS: Some respondents think that "meat" only applies to red meat, but we do mean all types of animal flesh.

```
  GO TO Q. #15  ====>  <1> Yes
  GO TO Q. #14  ====>  <2> No
```

*** QUESTION #14 ***

(If "no" to the previous question…)

Thank you for your time, but at this time we're only interviewing restaurants that cook meat.

```
  GO TO Q. #98  ====>  <1> Text
```

*** QUESTION #15 ***

We have your restaurant type listed as [type from the Dun & Bradstreet database]
Is this correct?

```
  GO TO Q. #17  ====>  <1> Yes
  GO TO Q. #16  ====>  <2> No
```

*** QUESTION #16 ***

(If "no" to the previous question…)

What restaurant type is your main listing in the Yellow Pages?

```
  GO TO Q. #17  ====>  <1> Response required
-- ANSWER REQUIRED --
```

*** QUESTION #17 ***

Does your restaurant consider itself as {26} Chain, Independent {26} or Franchise?

```
   GO TO Q. #19  ====>  <1> Chain
   GO TO Q. #19  ====>  <2> Independent
   GO TO Q. #19  ====>  <3> Franchise
   GO TO Q. #19  ====>  <4> Other
```

*** QUESTION #19 ***

Which of the following types of meat do you cook at your restaurant?

Do you cook...

(phone program will only ask the respondent about those meats that they do actually cook)

```
 .
 {26} INTERVIEWERS: You don't have to read the stuff in parentheses, but
 {26} please note that the category includes those things listed in
 {26} parentheses.
   GO TO Q. #21  ====>  <1> Steaks (includes "beef")
   GO TO Q. #21  ====>  <2> Hamburger (includes "ground beef")
   GO TO Q. #21  ====>  <3> Poultry, with skin (this includes chicken or
turkey)
   GO TO Q. #21  ====>  <4> Poultry--skinless (this includes chicken or turkey)
   GO TO Q. #21  ====>  <5> Pork (this includes ham, bacon, pork sausage, etc.)
   GO TO Q. #21  ====>  <6> Seafood (this includes "fish" and shellfish)
   GO TO Q. #20  ====>  <7> Other

 *** QUESTION #20 ***
```

(If "Other" is checked in the previous question…)

What other type of meat do you cook at your restaurant?

```
   GO TO Q. #21  ====>  <1> Response Required
```

*** QUESTION #21 ***

Now I would like to ask you questions about your cooking equipment.

How many charbroilers do you have?

If the answer is greater than "0", then ask the following questions about charbroiling equipment.

*** QUESTION #22 ***

Are your charbroilers Chain-Driven or Underfired? **(Only asked if respondent has charbroilers)**

```
 .
 {27}INTERVIEWER, FEEL FREE TO HELP THEM OUT WITH THE FOLLOWING
 {27}DEFINITIONS:
 {26}CHAIN-DRIVEN CHARBROILERS ARE CHARBROILERS THAT ARE AUTOMATED OR
 {26}CONVEYORIZED.
 {26}UNDERFIRED CHARBROILERS ARE NOT AUTOMATED AND INCLUDE
 {26}BROILERS, GRILL CHARBROILERS, FLAME-CHARBROILERS, AND DIRECT-FIRE
 {26}BARBECUES.
   GO TO Q. #23  ====>  <1> Chain-Driven
   GO TO Q. #23  ====>  <2> Underfired
```

*** QUESTION #23 ***
How many total pounds each of the following types of food do you cook in a typical week on your CHARBROILER(S)? **(Only asked if respondent has charbroilers)**

- How many pounds of Steaks do you cook on your CHARBROILER(S)? --By "steaks" I mean cuts of beef like filet mignon, tri tip, london broil, and ribeye.
- How many pounds of hamburger do you cook on your CHARBROILER(S)?
- How many pounds of Poultry with Skin do you cook on your CHARBROILER(S)? By "poultry" I mean meat like chicken and turkey.
- How many pounds of Skinless Poultry do you cook on your CHARBROILER(S)? By "Poultry" I mean meat like chicken and turkey.
- How many pounds of Pork do you cook on your CHARBROILER(S) in a typical week? By "Pork" I mean different types of pork products like pork loin, pork chops, ribs, bacon and pork sausage.
- How many pounds of Seafood do you cook on your CHARBROILER(S) in a typical week?
- How many pounds of [Q20]## ("Other") do you cook on your CHARBROILER(S) in a typical week?
- What is the source of heat for your charbroiler(s)?

```
GO TO Q. #39  ====>  <1> Gas
GO TO Q. #39  ====>  <2> Electricity
GO TO Q. #39  ====>  <3> Propane
GO TO Q. #39  ====>  <4> Wood
GO TO Q. #39  ====>  <5> Charcoal
```

*** QUESTION #39 ***(**Does not show up on interview screen, just adds up the sums)**
*This question calculates pounds of meat cooked on charbroilers.
GO TO Q. #40 ====> <1> $Q25+Q27+Q29+Q31+Q33+Q35+Q37

*** QUESTION #40 ***
How many deep-fat fryers do you have?
If the answer is greater than "0", then ask the following questions about deep-fat frying equipment.

How many total pounds each of the following types of food do you cook in a typical week on your DEEP-FAT FRYERS? **(Only asked if respondent has deep-fat fryers.)**

- How many pounds of Steaks do you cook on your DEEP-FAT FRYERS in a typical week? --By "steaks" I mean cuts of beef like filet mignon, tri tip, london broil, and ribeye.
- How many pounds of hamburger do you cook on your DEEP-FAT FRYERS in a typical week?
- How many pounds of Poultry with Skin do you cook on your DEEP-FAT FRYERS in a typical week? By "poultry" I mean meat like chicken and turkey.
- How many pounds of Skinless Poultry do you cook on your DEEP-FAT FRYERS in a typical week? By "Poultry" I mean meat like chicken and turkey.

- How many pounds of Pork do you cook on your DEEP-FAT FRYERS in a typical week? By "Pork" I mean different types of pork products like pork loin, pork chops, ribs, bacon and pork sausage.
- How many pounds of Seafood do you cook on your DEEP-FAT FRYERS in a typical week?
- How many pounds of [Q20]## ("Other") do you cook on your DEEP-FAT FRYERS?
- What is the source of heat for your deep-fat fryers?

```
GO TO Q. #57  ====>  <1> Gas
GO TO Q. #57  ====>  <2> Electricity
GO TO Q. #57  ====>  <3> Propane
GO TO Q. #57  ====>  <4> Wood
GO TO Q. #57  ====>  <5> Charcoal
```

*** QUESTION #57 *** ***(Does not show up on interview screen, just adds up the sums)**
*This question will calculate pounds of meat cooked on deep-fat fryers.

```
GO TO Q. #58  ====>  <1> $Q43+Q45+Q47+Q49+Q51+Q53+Q55
```

*** QUESTION #58 ***
How many griddles or grills do you have?
If the answer is greater than "0", then ask the following questions about griddles or grill-tops.

*** QUESTION #59 ***
Are your griddles or grills {26} Flat or Clamshell?

```
GO TO Q. #60  ====>  <1> Flat or groove topped
GO TO Q. #60  ====>  <2> Clamshell or double-sided
```

How many total pounds each of the following types of food do you cook in a typical week on your GRIDDLES OR GRILL-TOP(S)? **(Only asked if respondent has griddles or grill-tops)**

- How many pounds of Steaks do you cook on your GRIDDLES OR GRILL-TOPS in a typical week? --By "steaks" I mean cuts of beef like filet mignon, tri tip, london broil, and ribeye.
- How many pounds of hamburger do you cook on your GRIDDLES OR GRILL-TOPS in a typical week?
- How many pounds of Poultry with Skin do you cook on your GRIDDLES OR GRILL-TOPS in a typical week? By "poultry" I mean meat like chicken and turkey.
- How many pounds of Skinless Poultry do you cook on your GRIDDLES OR GRILL-TOPS in a typical week? By "Poultry" I mean meat like chicken and turkey.
- How many pounds of Pork do you cook on your GRIDDLES OR GRILL-TOPS in a typical week? By "Pork" I mean different types of pork products like pork loin, pork chops, ribs, bacon and pork sausage.
- How many pounds of Seafood do you cook on your GRIDDLES OR GRILL-TOPS in a typical week?
- How many pounds of [Q20]## ("Other") do you cook on your GRIDDLES OR GRILL-TOPS in a typical week?

- What is the source of heat for your griddles or grill-tops?

```
GO TO Q. #76  ====>  <1> Gas
GO TO Q. #76  ====>  <2> Electricity
GO TO Q. #76  ====>  <3> Propane
GO TO Q. #76  ====>  <4> Wood
GO TO Q. #76  ====>  <5> Charcoal
```

*** QUESTION #76 ******(Does not show up on interview screen, just adds up the sums)
*This question calculates pounds of meat cooked on griddles or grill-tops.

```
GO TO Q. #77  ====>  <1> $Q62+Q64+Q66+Q68+Q70+Q72+Q74
 -- FORMULA --
```

*** QUESTION #77 ******(Does not show up on interview screen, just adds up the sums)
*This question calculates the total amount of meat used by a restaurant.

```
GO TO Q. #78  ====>  <1> $Q39+Q57+Q76
 -- FORMULA --
```

*** QUESTION #78 ***
Where does your estimate of pounds of meat come from?

```
GO TO Q. #79  ====>  <1> Records of pounds of meat used
GO TO Q. #79  ====>  <2> Sales history and menu mix
GO TO Q. #79  ====>  <3> Calculated from amount spent on food
GO TO Q. #79  ====>  <4> A rough guess
```

*** QUESTION #79 ***
Now I am going to ask you some questions about the days and times your restaurant operates.
What days of the week is your restaurant open?

.

```
GO TO Q. #80  ====>  <1> Sunday
GO TO Q. #80  ====>  <2> Monday
GO TO Q. #80  ====>  <3> Tuesday
GO TO Q. #80  ====>  <4> Wednesday
GO TO Q. #80  ====>  <5> Thursday
GO TO Q. #80  ====>  <6> Friday
GO TO Q. #80  ====>  <7> Saturday
GO TO Q. #80  ====>  <10> All 7 Days of the Week
```

*** QUESTION #80 ***
Now I would like to ask you about weekends, which includes Friday Night, all day Saturday, and all day Sunday. Now, you said that you cook approximately [Q77]## pounds of meat per week on the equipment listed. On a typical weekend, how many of those [Q77]## pounds of meat do you cook?

*** QUESTION #81 ***
For what weekend meal do you cook the most meat (day and time)?
.
{26}WEEKENDS INCLUDE FRIDAY NIGHT, ALL DAY SATURDAY, AND ALL DAY
{26}SUNDAY.

```
   GO TO Q. #82  ====>  <1> Friday Dinner
   GO TO Q. #82  ====>  <2> Saturday Breakfast
   GO TO Q. #82  ====>  <3> Saturday Brunch
   GO TO Q. #82  ====>  <4> Saturday Lunch
   GO TO Q. #82  ====>  <5> Saturday Dinner
   GO TO Q. #82  ====>  <6> Sunday Breakfast
   GO TO Q. #82  ====>  <7> Sunday Brunch
   GO TO Q. #82  ====>  <8> Sunday Lunch
   GO TO Q. #82  ====>  <9> Sunday Dinner
```

*** QUESTION #82 ***
Now I would like to ask you about meals on weekdays. On a typical
weekday, for what meal do you cook the most meat?
.
WEEKDAYS INCLUDE ALL DAY MONDAY, TUESDAY, WEDNESDAY, AND
THURSDAY AND FRIDAY BREAKFAST AND LUNCH (NOT DINNER).

```
   GO TO Q. #83  ====>  <1> Breakfast (6 am to 11 am)
   GO TO Q. #83  ====>  <2> Lunch (11 am to 2 pm)
   GO TO Q. #83  ====>  <3> Dinner (4 pm to 9 pm)
   GO TO Q. #84  ====>  <4> Varies
```

*** QUESTION #83 ***
For that meal, do you cook:

```
   GO TO Q. #84  ====>  <1> Less than half of all the day's meat
   GO TO Q. #84  ====>  <2> About half of all of the day's meat
   GO TO Q. #84  ====>  <3> More than half of all the day's meat
```

*** QUESTION #84 ***
During a typical week, how many customers do you serve?
.

```
   GO TO Q. #85  ====>  <1> Response required
```

*** QUESTION #85 ***
Have you ever heard anything connecting commercial cooking and
air quality?

```
   GO TO Q. #86  ====>  <1> Yes
   GO TO Q. #97  ====>  <2> No
```

*** QUESTION #86 ***
What have you heard about commercial cooking and air quality?
.

```
{26} INTERVIEWERS: We need complete answers--we need to know what they
{26} heard about this issue--not a one-word answer.
```

*** QUESTION #87 ***
Where did you hear it?

.

```
{26} INTERVIEWERS: We need to know the source of their information.
{26} This means whether they heard it on the radio, on tv, in a seminar
{26} or in a magazine and who was the source of that information
{26} such as the California Restaurant Association,
{26} the Air Resources Board, etc.
  GO TO Q. #97  ====>  <1> Response Required
```

*** QUESTION #97 ***
That was my last question. Thank you very much for your help.

.

Appendix B—Frequencies

Q13. Do you cook meat at your restaurant? By meat I mean beef, chicken and other poultry, pork, seafood, etc.

	N	Percent
yes	655	96.0%
no	25	3.7%
refused	2	.3%
Total	682	100.0%

*After this point, all frequency tables refer only to restaurants that cook meat onsite.

Q15. Is this the correct listing for your restaurant?

	N	Percent
yes	604	92.2%
no	51	7.8%
Total	655	100.0%

Q17. Does your restaurant consider itself a Chain, Independent or Franchise?

	N	Percent
Chain	125	19.1%
Independent	408	62.3%
Franchise	114	17.4%
Other	7	1.1%
Don't know	1	.2%
Total	655	100.0%

Q21. Now I would like to ask you questions about your cooking equipment. How many charbroilers do you have?

	N	Percent
0	297	45.7%
1	268	41.2%
2	56	8.6%
3	8	1.2%
4	7	1.1%
5	5	.8%
6	6	.9%
7	1	.2%
10	2	.3%
Total	650	100.0%

Q22. Are your charbroilers Chain-Driven or Underfired?

	N	Percent
Chain-driven	51	14.4%
Underfired	293	83.0%
Don't Know	9	2.5%
Total	353	100.0%

Q24. If > 1 charbroiler, do they cook steak on their charbroiler(s)?

	N	Percent
More than one lb	243	83.8%
Zero pounds	13	4.5%
Don't Know	33	11.4%
Refused	1	.3%
Total	290	100.0%

Q26. If > 1 charbroiler, do they cook hamburger on their charbroiler(s)?

	N	Percent
More than one lb	177	80.5%
Zero pounds	19	8.6%
Don't Know	19	8.6%
Refused	5	2.3%
Total	220	100.0%

Q28. If > 1 charbroiler, do they cook poultry with skin on their charbroiler(s)?

	N	Percent
More than one lb	89	56.0%
Zero pounds	46	28.9%
Don't Know	21	13.2%
Refused	3	1.9%
Total	159	100.0%

Q30. If > 1 charbroiler, do they cook poultry without skin on their charbroiler(s)?

	N	Percent
More than one lb	209	71.3%
Zero pounds	53	18.1%
Don't Know	27	9.2%
Refused	4	1.4%
Total	293	100.0%

Q32. If > 1 charbroiler, do they cook pork on their charbroiler(s)?

	N	Percent
More than one lb	112	47.1%
Zero pounds	106	44.5%
Don't Know	17	7.1%
Refused	3	1.3%
Total	238	100.0%

Q34. If > 1 charbroiler, do they cook seafood on their charbroiler(s)?

	N	Percent
More than one lb	148	53.6%
Zero pounds	100	36.2%
Don't Know	24	8.7%
Refused	4	1.4%
Total	276	100.0%

Q36. If > 1 charbroiler, do they cook other meat on their charbroiler(s)?

	N	Percent
More than one lb	15	45.5%
Zero pounds	15	45.5%
Don't Know	3	9.1%
Total	33	100.0%

Q38. What is the source of heat for your charbroiler(s)?

	N	Percent
Gas	314	89.0%
Electricity	17	4.8%
Propane	7	2.0%
Wood	8	2.3%
Charcoal	5	1.4%
Don't Know	2	.6%
Total	353	100.0%

Q40. How many deep-fat fryers do you have?

	N	Percent
0	83	12.7%
1	227	34.8%
2	182	27.9%
3	66	10.1%
4	62	9.5%
5	13	2.0%
6	14	2.1%
7	3	.5%
8	2	.3%
10	1	.2%
Total	653	100.0%

Q42. If >1 deep-fat fryer, do they cook steaks in their deep-fat fryer(s)?

	N	Percent
More than one lb	32	7.8%
Zero pounds	357	87.5%
Don't Know	17	4.2%
Refused	2	.5%
Total	408	100.0%

Q44. If >1 deep-fat fryer, do they cook hamburger in their deep-fat fryer(s)?

	N	Percent
More than one lb	11	3.4%
Zero pounds	300	92.9%
Don't Know	9	2.8%
Refused	3	.9%
Total	323	100.0%

Q46. If >1 deep-fat fryer, do they cook poultry with skin in their deep-fat fryer(s)?

	N	Percent
More than one lb	78	33.1%
Zero pounds	134	56.8%
Don't Know	22	9.3%
Refused	2	.8%
Total	236	100.0%

Q48. If >1 deep-fat fryer, do they cook poultry without skin in their deep-fat fryer(s)?

	N	Percent
More than one lb	140	30.1%
Zero pounds	285	61.3%
Don't Know	36	7.7%
Refused	4	.9%
Total	465	100.0%

Q50. If >1 deep-fat fryer, do they cook pork in their deep-fat fryer(s)?

	N	Percent
More than one lb	74	18.9%
Zero pounds	296	75.7%
Don't Know	18	4.6%
Refused	3	.8%
Total	391	100.0%

Q52. If >1 deep-fat fryer, do they cook seafood in their deep-fat fryer(s)?

	N	Percent
More than one lb	234	56.9%
Zero pounds	138	33.6%
Don't Know	35	8.5%
Refused	4	1.0%
Total	411	100.0%

Q54. If >1 deep-fat fryer, do they cook other meat in their deep-fat fryer(s)?

	N	Percent
More than one lb	7	14.9%
Zero pounds	36	76.6%
Don't Know	4	8.5%
Total	47	100.0%

Q56. What is the source of heat for your deep-fat fryer(s)?

	N	Percent
Gas	467	81.9%
Electricity	89	15.6%
Propane	9	1.6%
Wood	1	.2%
Don't Know	3	.5%
Refused	1	.2%
Total	570	100.0%

Q58. How many griddles or grills do you have?

	N	Percent
0	202	31.0%
1	284	43.6%
2	114	17.5%
3	17	2.6%
4	12	1.8%
5	4	.6%
6	9	1.4%
7	1	.2%
8	2	.3%
9	1	.2%
12	2	.3%
16	1	.2%
20	2	.3%
Total	651	100.0%

Q59. Are your griddles or grills Flat or Clamshell?

	N	Percent
Flat or groove topped	409	90.3%
Clamshell or double-sided	41	9.1%
Don't know	3	.7%
Total	453	100.0%

Q61. If >1 deep-fat fryer, do they cook steak on their griddle(s)/grill(s)?

	N	Percent
More than one lb	175	49.4%
Zero pounds	142	40.1%
Don't Know	34	9.6%
Refused	3	.8%
Total	354	100.0%

Q63. If >1 deep-fat fryer, do they cook hamburger on their griddle(s)/grill(s)?

	N	Percent
More than one lb	156	54.7%
Zero pounds	107	37.5%
Don't Know	20	7.0%
Refused	2	.7%
Total	285	100.0%

Q65. If >1 deep-fat fryer, do they cook poultry with skin on their griddle(s)/grill(s)?

	N	Percent
More than one lb	58	28.4%
Zero pounds	124	60.8%
Don't Know	18	8.8%
Refused	4	2.0%
Total	204	100.0%

Q67. If >1 deep-fat fryer, do they cook poultry without skin on their griddle(s)/grill(s)?

	N	Percent
More than one lb	196	51.3%
Zero pounds	148	38.7%
Don't Know	36	9.4%
Refused	2	.5%
Total	382	100.0%

Q69. If >1 deep-fat fryer, do they cook pork on their griddle(s)/grill(s)?

	N	Percent
More than one lb	136	42.5%
Zero pounds	161	50.3%
Don't Know	19	5.9%
Refused	4	1.3%
Total	320	100.0%

Q71. If >1 deep-fat fryer, do they cook seafood on their griddle(s)/grill(s)?

	N	Percent
More than one lb	137	41.3%
Zero pounds	165	49.7%
Don't Know	27	8.1%
Refused	3	.9%
Total	332	100.0%

Q73. If >1 deep-fat fryer, do they cook other meat on their griddle(s)/grill(s)?

	N	Percent
More than one lb	11	31.4%
Zero pounds	20	57.1%
Don't Know	4	11.4%
Total	35	100.0%

Q75. What is the source of heat for your flat or groove top griddles(s)?

	N	Percent
Gas	385	85.0%
Electricity	49	10.8%
Propane	12	2.6%
Wood	3	.7%
Charcoal	2	.4%
Don't Know	2	.4%
Total	453	100.0%

Q78. Where does your estimate of pounds of meat come from--Records of pounds of meat used, sales history and menu mix, calculation based on amount spent on food, or a rough guess?

	N	Percent
Records of pounds of meat used	77	14.6%
Sales history and menu mix	98	18.6%
Calculated from amount spent on food	99	18.8%
A rough guess	242	46.0%
Don't know	8	1.5%
Refused	2	.4%
Total	526	100.0%

Q81. For what weekend meal do you cook the most meat (day and time)? Weekends include Friday night, all day Saturday, and all day Sunday.

	N	Percent
None of the above	52	7.9%
Friday Dinner	270	41.2%
Saturday Breakfast	14	2.1%
Saturday Brunch	4	.6%
Saturday Lunch	81	12.4%
Saturday Dinner	167	25.5%
Sunday Breakfast	20	3.1%
Sunday Brunch	4	.6%
Sunday Lunch	26	4.0%
Sunday Dinner	15	2.3%
Don't Know	2	.3%
Total	655	100.0%

Q82. Now I would like to ask you about meals on weekdays. On a typical weekday, for what meal do you cook the most meat--Breakfast, lunch or dinner?

	N	Percent
Breakfast	28	4.3%
Lunch	246	37.6%
Dinner	292	44.6%
Varies	80	12.2%
Don't know	7	1.1%
refused	1	.2%
Total	654	100.0%

Q83. For that meal, do you cook less than half of the day's meat, about half of all the day's meat, or more than half of all the day's meat?

	N	Percent
Varies	7	1.2%
Less than half of all the day's meat	64	11.3%
About half of all of the day's meat	217	38.3%
More than half of all the day's meat	243	42.9%
Don't know	34	6.0%
Refused	1	.2%
Total	566	100.0%

Q85. Have you ever heard anything connecting commercial cooking and air quality?

	N	Percent
yes	108	16.5%
no	533	81.4%
don't know	13	2.0%
refused	1	.2%
Total	655	100.0%

Main restaurant category

	N	Percent
Ethnic	380	58.0%
Fast Food	157	24.0%
Family	70	10.7%
Seafood	19	2.9%
Steak&BBQ	29	4.4%
Total	655	100.0%

Restaurant Type (detailed)

		Frequency	Valid Percent
Valid	American restaurant	58	8.9
	Barbecue restaurant	10	1.5
	Cajun restaurant	2	.3
	Chicken restaurant	7	1.1
	Chinese restaurant	85	13.0
	Drive-in restaurant	6	.9
	Fast-food restaurant, chain	100	15.3
	Fast-food restaurant, independent	26	4.0
	Fast food restaurants and stands	2	.3
	German restaurant	2	.3
	Greek restaurant	2	.3
	Grills (eating places)	14	2.1
	Hamburger stand	7	1.1
	Indian/Pakistan restaurant	9	1.4
	Italian restaurant	66	10.1
	Japanese restaurant	29	4.4
	Korean restaurant	1	.2
	Lebanese restaurant	1	.2
	Mexican restaurant	107	16.3
	Oyster bar	1	.2
	Pakistani restaurant	1	.2
	Restaurant, family	17	2.6
	Restaurant, family: chain	29	4.4
	Restaurant, family: indepen	24	3.7
	Seafood restaurants	18	2.7
	Spanish restaurant	2	.3
	Steak and barbecue restaurants	3	.5
	Steak restaurant	15	2.3
	Thai restaurant	8	1.2
	Vietnamese restaurant	3	.5
	Total	655	100.0

Do you cook steak?

	N	Percent
no	201	30.7%
yes	454	69.3%
Total	655	100.0%

Do you cook hamburger?

	N	Percent
no	306	46.7%
yes	349	53.3%
Total	655	100.0%

Do you cook poultry with skin?

	N	Percent
no	381	58.2%
yes	274	41.8%
Total	655	100.0%

Do you cook skinless poultry?

	N	Percent
no	131	20.0%
yes	524	80.0%
Total	655	100.0%

Do you cook pork?

	N	Percent
no	215	32.8%
yes	440	67.2%
Total	655	100.0%

Do you cook seafood?

	N	Percent
no	196	29.9%
yes	459	70.1%
Total	655	100.0%

Do you cook any other types of meat?

	N	Percent
no	596	91.0%
yes	59	9.0%
Total	655	100.0%

Are you open on Sunday?

	N	Percent
no	67	10.2%
yes	588	89.8%
Total	655	100.0%

Are you open on Monday?

	N	Percent
no	56	8.5%
yes	599	91.5%
Total	655	100.0%

Are you open on Tuesday?

	N	Percent
no	16	2.4%
yes	639	97.6%
Total	655	100.0%

Are you open on Wednesday?

	N	Percent
no	11	1.7%
yes	644	98.3%
Total	655	100.0%

Are you open on Thursday?

	N	Percent
no	2	.3%
yes	653	99.7%
Total	655	100.0%

Are you open on Friday?

	N	Percent
no	2	.3%
yes	653	99.7%
Total	655	100.0%

Are you open on Saturday?

	N	Percent
no	11	1.7%
yes	644	98.3%
Total	655	100.0%

Open all 7 days of the week?

	N	Percent
no	129	19.7%
yes	526	80.3%
Total	655	100.0%

Status

	N	Percent
Single Location	457	69.8%
Headquarters Location	16	2.4%
Branch Location	182	27.8%
Total	655	100.0%

Appendix C—Regression Models

Regression models using only predictors available in sampling frame

Charbroiled Steak

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.378[a]	.143	.128	.8843

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Family, Mexican, Chinese, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	76.578	10	7.658	9.792	.000[a]
	Residual	460.636	589	.782		
	Total	537.215	599			

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Family, Mexican, Chinese, Fast Food

b. Dependent Variable: Char steak

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	6.817E-02	.165		.413	.680	-.256	.392
	Fast Food	-.225	.139	-.102	-1.614	.107	-.498	.049
	Family	.451	.163	.147	2.763	.006	.131	.772
	Seafood	.118	.235	.022	.504	.615	-.343	.580
	Steak	.475	.204	.108	2.324	.020	.074	.876
	American	.419	.170	.123	2.470	.014	.086	.752
	Chinese	-.273	.152	-.098	-1.800	.072	-.572	.025
	Italian	.227	.164	.072	1.386	.166	-.095	.548
	Mexican	.543	.147	.209	3.693	.000	.254	.832
	City 500K+	.103	.086	.046	1.199	.231	-.066	.271
	log Employees on site	.308	.096	.137	3.224	.001	.120	.496

a. Dependent Variable: Char steak

Charbroiled Hamburger

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.382[a]	.146	.131	.8573

a. Predictors: (Constant), log Employees on site, City 500K+, Italian, Seafood, American, Steak, Mexican, Family, Chinese, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	74.338	10	7.434	10.114	.000[a]
	Residual	435.115	592	.735		
	Total	509.452	602			

a. Predictors: (Constant), log Employees on site, City 500K+, Italian, Seafood, American, Steak, Mexican, Family, Chinese, Fast Food

b. Dependent Variable: Char hamburger

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-.244	.157		-1.557	.120	-.553	.064
	Fast Food	.634	.133	.298	4.784	.000	.374	.895
	Family	.643	.155	.220	4.142	.000	.338	.948
	Seafood	.170	.243	.030	.702	.483	-.307	.647
	Steak	.434	.199	.099	2.182	.030	.043	.824
	American	.522	.161	.161	3.241	.001	.206	.838
	Chinese	-7.62E-02	.144	-.028	-.529	.597	-.359	.207
	Italian	.148	.156	.049	.949	.343	-.158	.455
	Mexican	.153	.143	.058	1.069	.285	-.128	.433
	City 500K+	8.419E-02	.084	.039	1.007	.314	-.080	.248
	log Employees on site	.285	.094	.129	3.046	.002	.101	.469

a. Dependent Variable: Char hamburger

Charbroiled poultry - with skin

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.236[a]	.056	.040	.5978

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, American, Italian, Steak, Mexican, Family, Chinese, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.844	10	1.284	3.594	.000[a]
	Residual	216.948	607	.357		
	Total	229.792	617			

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, American, Italian, Steak, Mexican, Family, Chinese, Fast Food

b. Dependent Variable: Char poultry - skin

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-1.49E-03	.109		-.014	.989	-.215	.212
	Fast Food	-2.64E-02	.093	-.019	-.285	.775	-.208	.155
	Family	-4.75E-02	.109	-.024	-.433	.665	-.262	.168
	Seafood	-6.53E-02	.161	-.018	-.405	.686	-.382	.252
	Steak	.536	.139	.183	3.849	.000	.262	.809
	American	.130	.111	.061	1.168	.243	-.089	.349
	Chinese	-2.24E-02	.101	-.012	-.222	.824	-.220	.176
	Italian	4.326E-02	.108	.021	.399	.690	-.170	.256
	Mexican	-5.56E-02	.098	-.033	-.568	.570	-.248	.137
	City 500K+	4.864E-02	.057	.034	.847	.398	-.064	.161
	log Employees on site	.135	.064	.093	2.122	.034	.010	.260

a. Dependent Variable: Char poultry - skin

Charbroiled Poultry - Without Skin

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.236[a]	.056	.040	.8784

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Mexican, Family, Chinese, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	26.925	10	2.693	3.490	.000[a]
	Residual	456.011	591	.772		
	Total	482.937	601			

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Mexican, Family, Chinese, Fast Food

b. Dependent Variable: Char poultry - no skin

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-3.46E-02	.163		-.212	.832	-.354	.285
	Fast Food	-.131	.138	-.063	-.952	.342	-.402	.140
	Family	.211	.164	.071	1.286	.199	-.111	.532
	Seafood	-.259	.255	-.045	-1.016	.310	-.759	.241
	Steak	.272	.208	.063	1.308	.191	-.136	.681
	American	.159	.168	.049	.948	.343	-.170	.489
	Chinese	-2.45E-02	.149	-.009	-.165	.869	-.317	.268
	Italian	9.552E-02	.160	.033	.599	.550	-.218	.409
	Mexican	.111	.145	.045	.765	.444	-.173	.395
	City 500K+	.165	.086	.078	1.912	.056	-.005	.335
	log Employees on site	.349	.095	.165	3.684	.000	.163	.536

a. Dependent Variable: Char poultry - no skin

Charbroiled Pork

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.230[a]	.053	.037	.5936

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, American, Italian, Steak, Family, Chinese, Mexican, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.581	10	1.158	3.286	.000[a]
	Residual	206.499	586	.352		
	Total	218.080	596			

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, American, Italian, Steak, Family, Chinese, Mexican, Fast Food

b. Dependent Variable: Char pork

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-3.22E-02	.110		-.294	.769	-.247	.183
	Fast Food	-5.44E-02	.094	-.039	-.579	.562	-.239	.130
	Family	1.037E-02	.112	.005	.093	.926	-.210	.230
	Seafood	-.199	.164	-.055	-1.213	.226	-.522	.123
	Steak	.494	.137	.176	3.592	.000	.224	.764
	American	.163	.114	.075	1.427	.154	-.061	.387
	Chinese	2.223E-02	.102	.013	.219	.827	-.177	.222
	Italian	2.709E-03	.110	.001	.025	.980	-.213	.219
	Mexican	6.416E-02	.098	.039	.656	.512	-.128	.256
	City 500K+	6.744E-02	.058	.047	1.156	.248	-.047	.182
	log Employees on site	.136	.064	.095	2.116	.035	.010	.263

a. Dependent Variable: Char pork

Charbroiled Seafood

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.316[a]	.100	.085	.6893

a. Predictors: (Constant), log Employees on site, City 500K+, Italian, Seafood, American, Steak, Mexican, Family, Chinese, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	31.044	10	3.104	6.533	.000[a]
	Residual	279.419	588	.475		
	Total	310.463	598			

a. Predictors: (Constant), log Employees on site, City 500K+, Italian, Seafood, American, Steak, Mexican, Family, Chinese, Fast Food

b. Dependent Variable: Char seafood

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-.166	.130		-1.279	.202	-.420	.089
	Fast Food	-.290	.109	-.174	-2.667	.008	-.504	-.076
	Family	1.516E-02	.129	.006	.118	.906	-.238	.268
	Seafood	.275	.184	.067	1.497	.135	-.086	.635
	Steak	.243	.160	.072	1.519	.129	-.071	.557
	American	.172	.132	.067	1.300	.194	-.088	.432
	Chinese	-3.78E-02	.118	-.018	-.320	.749	-.270	.194
	Italian	.170	.128	.071	1.331	.184	-.081	.422
	Mexican	3.541E-02	.116	.018	.305	.760	-.192	.263
	City 500K+	.126	.068	.073	1.845	.066	-.008	.259
	log Employees on site	.343	.075	.200	4.602	.000	.197	.489

a. Dependent Variable: Char seafood

Charbroiled Other Meat

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.143[a]	.021	.005	.1964

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Mexican, Family, Chinese, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.499	10	4.992E-02	1.294	.230[a]
	Residual	23.809	617	3.859E-02		
	Total	24.308	627			

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Mexican, Family, Chinese, Fast Food

b. Dependent Variable: Char other meat

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	8.091E-02	.036		2.269	.024	.011	.151
	Fast Food	-8.00E-02	.030	-.173	-2.630	.009	-.140	-.020
	Family	-3.53E-02	.035	-.056	-.999	.318	-.105	.034
	Seafood	-8.59E-02	.052	-.075	-1.653	.099	-.188	.016
	Steak	-8.39E-02	.045	-.089	-1.859	.064	-.172	.005
	American	-6.22E-02	.036	-.090	-1.709	.088	-.134	.009
	Chinese	-7.09E-02	.033	-.121	-2.139	.033	-.136	-.006
	Italian	-4.48E-02	.036	-.068	-1.258	.209	-.115	.025
	Mexican	-8.65E-02	.032	-.161	-2.708	.007	-.149	-.024
	City 500K+	1.874E-02	.019	.041	1.009	.314	-.018	.055
	log Employees on site	-6.66E-03	.021	-.014	-.322	.747	-.047	.034

a. Dependent Variable: Char other meat

Total Charbroiled Meat

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.280[a]	.078	.064	1.1972

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Mexican, Family, Chinese, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	75.852	10	7.585	5.292	.000[a]
	Residual	891.489	622	1.433		
	Total	967.340	632			

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Mexican, Family, Chinese, Fast Food

b. Dependent Variable: Char total

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	8.845E-02	.216		.409	.683	-.336	.513
	Fast Food	.166	.184	.057	.901	.368	-.196	.528
	Family	.458	.215	.115	2.131	.033	.036	.880
	Seafood	2.295E-03	.316	.000	.007	.994	-.619	.623
	Steak	.705	.274	.119	2.568	.010	.166	1.244
	American	.478	.221	.110	2.161	.031	.044	.912
	Chinese	-.160	.201	-.044	-.798	.425	-.554	.234
	Italian	.262	.215	.064	1.220	.223	-.160	.683
	Mexican	.445	.194	.131	2.299	.022	.065	.825
	City 500K+	.279	.113	.096	2.461	.014	.056	.501
	log Employees on site	.431	.126	.146	3.427	.001	.184	.679

a. Dependent Variable: Char total

Fried Steak

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.161[a]	.026	.010	.3699

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Family, Chinese, Mexican, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.234	10	.223	1.633	.093[a]
	Residual	84.285	616	.137		
	Total	86.519	626			

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Family, Chinese, Mexican, Fast Food

b. Dependent Variable: Fry steak

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	1.267E-02	.068		.187	.852	-.120	.146
	Fast Food	-8.35E-02	.058	-.096	-1.451	.147	-.197	.030
	Family	-6.02E-02	.067	-.051	-.900	.368	-.192	.071
	Seafood	-2.06E-02	.100	-.009	-.206	.837	-.217	.176
	Steak	-.116	.085	-.066	-1.362	.174	-.283	.051
	American	-9.16E-02	.069	-.070	-1.331	.184	-.227	.044
	Chinese	4.918E-02	.063	.045	.784	.433	-.074	.172
	Italian	-.117	.067	-.096	-1.746	.081	-.248	.015
	Mexican	2.575E-02	.061	.025	.424	.672	-.093	.145
	City 500K+	6.119E-02	.035	.070	1.742	.082	-.008	.130
	log Employees on site	4.523E-02	.039	.051	1.160	.246	-.031	.122

a. Dependent Variable: Fry steak

Fried Hamburger

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.127[a]	.016	.000	.2537

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Family, Chinese, Mexican, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.657	10	6.571E-02	1.021	.424[a]
	Residual	39.919	620	6.439E-02		
	Total	40.577	630			

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Family, Chinese, Mexican, Fast Food

b. Dependent Variable: Fry hamburger

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-3.13E-03	.046		-.068	.946	-.094	.087
	Fast Food	7.979E-02	.039	.134	2.032	.043	.003	.157
	Family	3.183E-02	.046	.039	.697	.486	-.058	.122
	Seafood	9.514E-02	.067	.064	1.417	.157	-.037	.227
	Steak	7.792E-03	.058	.006	.134	.894	-.107	.122
	American	3.963E-03	.047	.004	.084	.933	-.088	.096
	Chinese	2.432E-02	.043	.032	.568	.570	-.060	.108
	Italian	3.964E-03	.046	.005	.087	.931	-.086	.094
	Mexican	2.024E-02	.041	.029	.491	.624	-.061	.101
	City 500K+	1.865E-02	.024	.031	.777	.437	-.028	.066
	log Employees on site	-1.21E-02	.027	-.020	-.452	.652	-.064	.040

a. Dependent Variable: Fry hamburger

Fried Poultry - With Skin

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.221[a]	.049	.033	.6315

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Mexican, Family, Chinese, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.470	10	1.247	3.127	.001[a]
	Residual	242.034	607	.399		
	Total	254.503	617			

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Mexican, Family, Chinese, Fast Food

b. Dependent Variable: Fry poultry - skin

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	5.148E-02	.115		.448	.655	-.174	.277
	Fast Food	.345	.098	.229	3.512	.000	.152	.537
	Family	.173	.114	.084	1.513	.131	-.052	.398
	Seafood	4.304E-02	.170	.011	.253	.801	-.292	.378
	Steak	.174	.147	.057	1.188	.235	-.114	.463
	American	.189	.118	.083	1.598	.110	-.043	.421
	Chinese	.143	.107	.075	1.341	.180	-.067	.353
	Italian	-1.73E-02	.114	-.008	-.152	.879	-.240	.206
	Mexican	-1.94E-02	.103	-.011	-.188	.851	-.222	.183
	City 500K+	6.899E-02	.060	.046	1.142	.254	-.050	.188
	log Employees on site	-3.49E-02	.067	-.023	-.524	.601	-.166	.096

a. Dependent Variable: Fry poultry - skin

Fried Poultry - Without Skin

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.317[a]	.101	.086	.7577

a. Predictors: (Constant), log Employees on site, City 500K+, Italian, Seafood, Steak, American, Family, Chinese, Mexican, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	38.619	10	3.862	6.727	.000[a]
	Residual	345.598	602	.574		
	Total	384.217	612			

a. Predictors: (Constant), log Employees on site, City 500K+, Italian, Seafood, Steak, American, Family, Chinese, Mexican, Fast Food

b. Dependent Variable: Fry poultry - no skin

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	4.924E-02	.141		.350	.726	-.227	.325
	Fast Food	.113	.119	.061	.954	.340	-.120	.346
	Family	-.117	.138	-.046	-.849	.396	-.388	.154
	Seafood	-5.52E-03	.201	-.001	-.027	.978	-.400	.389
	Steak	-.328	.176	-.087	-1.862	.063	-.675	.018
	American	-.167	.144	-.059	-1.163	.245	-.450	.115
	Chinese	.562	.129	.242	4.371	.000	.309	.814
	Italian	-.239	.138	-.091	-1.726	.085	-.511	.033
	Mexican	-.156	.124	-.072	-1.259	.208	-.400	.088
	City 500K+	2.860E-02	.074	.015	.388	.698	-.116	.173
	log Employees on site	.236	.081	.126	2.927	.004	.078	.395

a. Dependent Variable: Fry poultry - no skin

Fried Pork

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.349[a]	.122	.107	.4454

a. Predictors: (Constant), log Employees on site, City 500K+, Italian, Seafood, American, Steak, Mexican, Family, Chinese, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.620	10	1.662	8.379	.000[a]
	Residual	120.002	605	.198		
	Total	136.622	615			

a. Predictors: (Constant), log Employees on site, City 500K+, Italian, Seafood, American, Steak, Mexican, Family, Chinese, Fast Food

b. Dependent Variable: Fry pork

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.195	.083		2.355	.019	.032	.357
	Fast Food	-2.50E-02	.070	-.023	-.355	.722	-.163	.113
	Family	-.106	.082	-.070	-1.290	.198	-.267	.055
	Seafood	-3.25E-02	.119	-.012	-.274	.784	-.266	.201
	Steak	-8.77E-02	.103	-.039	-.848	.397	-.291	.115
	American	-.115	.084	-.070	-1.368	.172	-.279	.050
	Chinese	.400	.078	.281	5.148	.000	.247	.552
	Italian	-.115	.081	-.075	-1.410	.159	-.275	.045
	Mexican	-3.62E-02	.074	-.028	-.487	.627	-.183	.110
	City 500K+	9.412E-03	.043	.009	.220	.826	-.074	.093
	log Employees on site	-4.82E-02	.047	-.043	-1.020	.308	-.141	.045

a. Dependent Variable: Fry pork

Fried Seafood

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.366[a]	.134	.118	.7813

a. Predictors: (Constant), log Employees on site, City 500K+, Italian, Seafood, American, Steak, Family, Mexican, Chinese, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	51.066	10	5.107	8.366	.000[a]
	Residual	329.597	540	.610		
	Total	380.662	550			

a. Predictors: (Constant), log Employees on site, City 500K+, Italian, Seafood, American, Steak, Family, Mexican, Chinese, Fast Food

b. Dependent Variable: Fry seafood

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.119	.154		.769	.442	-.184	.422
	Fast Food	-.204	.130	-.105	-1.574	.116	-.459	.051
	Family	3.782E-03	.154	.001	.024	.980	-.300	.307
	Seafood	1.217	.215	.260	5.664	.000	.795	1.638
	Steak	.108	.196	.027	.553	.580	-.276	.493
	American	7.668E-02	.153	.027	.500	.617	-.225	.378
	Chinese	1.537E-02	.141	.006	.109	.913	-.261	.292
	Italian	-.182	.147	-.070	-1.241	.215	-.471	.106
	Mexican	-.295	.138	-.127	-2.143	.033	-.565	-.025
	City 500K+	4.912E-02	.082	.024	.601	.548	-.111	.210
	log Employees on site	.310	.088	.155	3.508	.000	.136	.483

a. Dependent Variable: Fry seafood

Other Fried Meat

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.114[a]	.013	-.003	.1816

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Family, Chinese, Mexican, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.270	10	2.698E-02	.818	.611[a]
	Residual	20.450	620	3.298E-02		
	Total	20.720	630			

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Family, Chinese, Mexican, Fast Food

b. Dependent Variable: Fry other meat

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	5.577E-03	.033		.170	.865	-.059	.070
	Fast Food	3.217E-02	.028	.076	1.149	.251	-.023	.087
	Family	5.346E-03	.033	.009	.164	.870	-.059	.069
	Seafood	4.220E-03	.048	.004	.088	.930	-.090	.098
	Steak	9.131E-02	.042	.106	2.193	.029	.010	.173
	American	3.017E-02	.034	.047	.899	.369	-.036	.096
	Chinese	1.505E-02	.030	.028	.495	.621	-.045	.075
	Italian	3.399E-03	.033	.006	.104	.917	-.061	.068
	Mexican	1.355E-03	.029	.003	.046	.963	-.056	.059
	City 500K+	7.837E-03	.017	.018	.455	.649	-.026	.042
	log Employees on site	-1.18E-02	.019	-.027	-.617	.537	-.049	.026

a. Dependent Variable: Fry other meat

Total Fried Meat

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.343[a]	.117	.103	1.0239

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Mexican, Family, Chinese, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	86.822	10	8.682	8.282	.000[a]
	Residual	652.091	622	1.048		
	Total	738.912	632			

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Mexican, Family, Chinese, Fast Food

b. Dependent Variable: Fry total

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.170	.185		.917	.359	-.193	.533
	Fast Food	.312	.158	.123	1.979	.048	.002	.621
	Family	2.169E-02	.184	.006	.118	.906	-.339	.383
	Seafood	1.043	.271	.165	3.856	.000	.512	1.574
	Steak	6.810E-02	.235	.013	.290	.772	-.393	.529
	American	-3.45E-02	.189	-.009	-.182	.855	-.406	.337
	Chinese	.621	.172	.194	3.622	.000	.284	.958
	Italian	-.321	.183	-.090	-1.747	.081	-.681	.040
	Mexican	-.191	.166	-.064	-1.153	.249	-.516	.134
	City 500K+	.233	.097	.092	2.410	.016	.043	.423
	log Employees on site	.338	.108	.131	3.143	.002	.127	.550

a. Dependent Variable: Fry total

Grilled Steak

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.314[a]	.098	.083	.7726

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Mexican, Family, Chinese, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	38.390	10	3.839	6.432	.000[a]
	Residual	351.553	589	.597		
	Total	389.943	599			

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Mexican, Family, Chinese, Fast Food

b. Dependent Variable: Grill steak

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.259	.144		1.798	.073	-.024	.541
	Fast Food	-.183	.122	-.098	-1.494	.136	-.423	.057
	Family	.104	.143	.040	.724	.469	-.177	.385
	Seafood	-5.44E-02	.206	-.012	-.264	.792	-.459	.350
	Steak	.608	.183	.156	3.319	.001	.248	.968
	American	.112	.149	.039	.754	.451	-.180	.404
	Chinese	-.241	.133	-.102	-1.812	.071	-.502	.020
	Italian	-9.05E-02	.144	-.034	-.630	.529	-.373	.192
	Mexican	.430	.130	.192	3.311	.001	.175	.684
	City 500K+	4.963E-02	.076	.026	.657	.511	-.099	.198
	log Employees on site	8.144E-02	.083	.043	.976	.330	-.082	.245

a. Dependent Variable: Grill steak

Grilled Hamburger

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.403[a]	.162	.148	.8571

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Mexican, Family, Chinese, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	84.503	10	8.450	11.502	.000[a]
	Residual	436.412	594	.735		
	Total	520.915	604			

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Mexican, Family, Chinese, Fast Food

b. Dependent Variable: Grill hamburger

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-.144	.157		-.916	.360	-.452	.164
	Fast Food	.792	.133	.366	5.957	.000	.531	1.053
	Family	.481	.155	.164	3.108	.002	.177	.784
	Seafood	5.965E-02	.227	.011	.263	.792	-.385	.505
	Steak	.366	.210	.077	1.737	.083	-.048	.779
	American	.447	.159	.139	2.809	.005	.135	.760
	Chinese	-9.96E-03	.145	-.004	-.069	.945	-.294	.274
	Italian	-4.93E-02	.155	-.016	-.318	.751	-.354	.255
	Mexican	.271	.142	.103	1.909	.057	-.008	.551
	City 500K+	-.132	.084	-.060	-1.580	.115	-.296	.032
	log Employees on site	.298	.093	.135	3.218	.001	.116	.480

a. Dependent Variable: Grill hamburger

Grilled Poultry - With Skin

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.139[a]	.019	.003	.4438

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, American, Italian, Steak, Mexican, Family, Chinese, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.352	10	.235	1.194	.291[a]
	Residual	119.161	605	.197		
	Total	121.513	615			

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, American, Italian, Steak, Mexican, Family, Chinese, Fast Food

b. Dependent Variable: Grill poultry - skin

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.141	.081		1.737	.083	-.018	.300
	Fast Food	-.148	.070	-.143	-2.123	.034	-.284	-.011
	Family	-.114	.082	-.079	-1.393	.164	-.275	.047
	Seafood	-.156	.118	-.061	-1.320	.187	-.387	.076
	Steak	4.855E-02	.103	.023	.473	.636	-.153	.250
	American	-8.48E-02	.083	-.054	-1.017	.310	-.248	.079
	Chinese	-.157	.076	-.120	-2.080	.038	-.306	-.009
	Italian	-6.68E-02	.082	-.045	-.818	.414	-.227	.093
	Mexican	-6.33E-02	.074	-.051	-.860	.390	-.208	.081
	City 500K+	4.961E-02	.042	.048	1.169	.243	-.034	.133
	log Employees on site	2.655E-02	.047	.025	.564	.573	-.066	.119

a. Dependent Variable: Grill poultry - skin

Grilled Poultry - Without Skin

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.192[a]	.037	.020	.7895

a. Predictors: (Constant), log Employees on site, City 500K+, Italian, Seafood, American, Steak, Family, Mexican, Chinese, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13.766	10	1.377	2.208	.016[a]
	Residual	359.685	577	.623		
	Total	373.450	587			

a. Predictors: (Constant), log Employees on site, City 500K+, Italian, Seafood, American, Steak, Family, Mexican, Chinese, Fast Food

b. Dependent Variable: Grill poultry - no skin

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.246	.147		1.679	.094	-.042	.534
	Fast Food	6.863E-02	.124	.037	.555	.579	-.174	.311
	Family	.116	.146	.045	.796	.427	-.171	.404
	Seafood	-.331	.209	-.073	-1.584	.114	-.742	.080
	Steak	6.981E-02	.186	.018	.375	.708	-.296	.435
	American	.197	.154	.067	1.282	.200	-.105	.499
	Chinese	-.118	.133	-.051	-.883	.378	-.379	.144
	Italian	4.247E-04	.145	.000	.003	.998	-.285	.286
	Mexican	.254	.130	.116	1.948	.052	-.002	.510
	City 500K+	-4.33E-02	.078	-.023	-.552	.581	-.197	.111
	log Employees on site	.142	.086	.075	1.656	.098	-.026	.310

a. Dependent Variable: Grill poultry - no skin

Grilled Pork

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.312[a]	.098	.082	.6620

a. Predictors: (Constant), log Employees on site, City 500K+, Italian, Seafood, American, Steak, Family, Mexican, Chinese, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	27.835	10	2.783	6.352	.000[a]
	Residual	257.226	587	.438		
	Total	285.061	597			

a. Predictors: (Constant), log Employees on site, City 500K+, Italian, Seafood, American, Steak, Family, Mexican, Chinese, Fast Food

b. Dependent Variable: Grill pork

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-9.15E-03	.124		-.074	.941	-.253	.235
	Fast Food	.190	.105	.118	1.811	.071	-.016	.397
	Family	.540	.124	.237	4.353	.000	.296	.783
	Seafood	2.413E-03	.176	.001	.014	.989	-.344	.349
	Steak	.714	.157	.215	4.544	.000	.406	1.023
	American	.309	.126	.127	2.456	.014	.062	.557
	Chinese	3.163E-02	.113	.016	.279	.780	-.191	.254
	Italian	-1.76E-02	.122	-.008	-.144	.886	-.258	.223
	Mexican	.149	.111	.078	1.341	.180	-.069	.367
	City 500K+	-1.52E-02	.066	-.009	-.232	.817	-.144	.114
	log Employees on site	.106	.072	.065	1.478	.140	-.035	.246

a. Dependent Variable: Grill pork

Grilled Seafood

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.342[a]	.117	.102	.5967

a. Predictors: (Constant), log Employees on site, City 500K+, Italian, Seafood, American, Steak, Family, Mexican, Chinese, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	26.915	10	2.691	7.560	.000[a]
	Residual	202.569	569	.356		
	Total	229.483	579			

a. Predictors: (Constant), log Employees on site, City 500K+, Italian, Seafood, American, Steak, Family, Mexican, Chinese, Fast Food

b. Dependent Variable: Grill seafood

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-8.90E-02	.114		-.779	.436	-.313	.135
	Fast Food	-.411	.097	-.285	-4.236	.000	-.601	-.220
	Family	-.301	.120	-.135	-2.511	.012	-.536	-.065
	Seafood	9.440E-02	.164	.026	.577	.564	-.227	.416
	Steak	-8.50E-02	.147	-.027	-.577	.564	-.374	.204
	American	5.872E-02	.117	.027	.503	.616	-.171	.288
	Chinese	-.194	.104	-.107	-1.859	.064	-.399	.011
	Italian	-4.48E-02	.113	-.022	-.395	.693	-.268	.178
	Mexican	1.702E-02	.104	.010	.164	.870	-.187	.221
	City 500K+	8.732E-02	.060	.058	1.452	.147	-.031	.205
	log Employees on site	.352	.065	.235	5.396	.000	.224	.480

a. Dependent Variable: Grill seafood

Other Grilled Meat

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.224[a]	.050	.035	.1889

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Mexican, Family, Chinese, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.170	10	.117	3.277	.000[a]
	Residual	22.099	619	3.570E-02		
	Total	23.270	629			

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Mexican, Family, Chinese, Fast Food

b. Dependent Variable: Grill other meat

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	3.516E-02	.034		1.029	.304	-.032	.102
	Fast Food	-4.76E-02	.029	-.106	-1.636	.102	-.105	.010
	Family	-4.42E-02	.034	-.072	-1.302	.193	-.111	.022
	Seafood	-4.63E-02	.051	-.040	-.910	.363	-.146	.054
	Steak	.150	.043	.163	3.461	.001	.065	.235
	American	-4.51E-02	.035	-.067	-1.292	.197	-.114	.023
	Chinese	-4.69E-02	.032	-.082	-1.477	.140	-.109	.015
	Italian	3.597E-03	.034	.006	.106	.916	-.063	.070
	Mexican	-2.78E-02	.031	-.053	-.909	.364	-.088	.032
	City 500K+	1.828E-02	.018	.040	1.018	.309	-.017	.054
	log Employees on site	-2.32E-03	.020	-.005	-.116	.907	-.041	.037

a. Dependent Variable: Grill other meat

Total Grilled Meat

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.331[a]	.109	.095	1.1263

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Mexican, Family, Chinese, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	96.892	10	9.689	7.638	.000[a]
	Residual	789.068	622	1.269		
	Total	885.960	632			

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Mexican, Family, Chinese, Fast Food

b. Dependent Variable: Grill total

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.227	.203		1.116	.265	-.172	.626
	Fast Food	.345	.173	.124	1.988	.047	.004	.685
	Family	.411	.202	.108	2.031	.043	.014	.808
	Seafood	-1.57E-03	.298	.000	-.005	.996	-.586	.583
	Steak	.530	.258	.094	2.054	.040	.023	1.037
	American	.481	.208	.115	2.312	.021	.072	.890
	Chinese	-.375	.189	-.107	-1.987	.047	-.745	-.004
	Italian	-.126	.202	-.032	-.624	.533	-.522	.271
	Mexican	.477	.182	.147	2.619	.009	.119	.835
	City 500K+	7.031E-02	.106	.025	.660	.509	-.139	.279
	log Employees on site	.429	.118	.152	3.623	.000	.197	.662

a. Dependent Variable: Grill total

Total Meat, All Cooking Methods

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.317[a]	.101	.086	1.1105

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Mexican, Family, Chinese, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	85.732	10	8.573	6.952	.000[a]
	Residual	767.098	622	1.233		
	Total	852.831	632			

a. Predictors: (Constant), log Employees on site, City 500K+, Seafood, Italian, American, Steak, Mexican, Family, Chinese, Fast Food

b. Dependent Variable: Question-based total

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	1.001	.201		4.991	.000	.607	1.395
	Fast Food	.530	.171	.195	3.103	.002	.195	.866
	Family	.297	.199	.080	1.492	.136	-.094	.689
	Seafood	.559	.293	.082	1.905	.057	-.017	1.135
	Steak	.675	.255	.122	2.651	.008	.175	1.175
	American	.387	.205	.095	1.884	.060	-.016	.789
	Chinese	3.975E-03	.186	.001	.021	.983	-.361	.369
	Italian	-.279	.199	-.073	-1.401	.162	-.670	.112
	Mexican	.385	.180	.121	2.142	.033	.032	.737
	City 500K+	.200	.105	.073	1.903	.057	-.006	.406
	log Employees on site	.421	.117	.152	3.607	.000	.192	.651

a. Dependent Variable: Question-based total

Models Including Questionnaire Items
Total Charbroiled Meat

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.806[a]	.650	.635	.7593

a. Predictors: (Constant), Q58. How many griddles or grills?, Steak, How many deep-fat fryers?, City 500K+, American, Seafood, Prop on Wknds, N Charbroilers, Family, Chain-Driven Charbroiler, Italian, Chinese, log Employees on site, Mexican, Customers per week, Independent, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	417.443	17	24.555	42.592	.000[a]
	Residual	224.845	390	.577		
	Total	642.287	407			

a. Predictors: (Constant), Q58. How many griddles or grills?, Steak, How many deep-fat fryers?, City 500K+, American, Seafood, Prop on Wknds, N Charbroilers, Family, Chain-Driven Charbroiler, Italian, Chinese, log Employees on site, Mexican, Customers per week, Independent, Fast Food

b. Dependent Variable: Char total

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-1.184	.302		-3.923	.000	-1.778	-.591
	Fast Food	.115	.167	.039	.686	.493	-.214	.443
	Family	.259	.173	.067	1.500	.134	-.080	.598
	Seafood	-.181	.238	-.027	-.758	.449	-.649	.287
	Steak	.326	.223	.053	1.461	.145	-.113	.764
	American	.319	.169	.078	1.883	.060	-.014	.652
	Chinese	7.942E-03	.172	.002	.046	.963	-.330	.346
	Italian	4.627E-03	.176	.001	.026	.979	-.342	.351
	Mexican	.172	.155	.050	1.107	.269	-.133	.477
	City 500K+	.168	.090	.057	1.861	.063	-.009	.345
	log Employees on site	.331	.117	.111	2.835	.005	.101	.560
	Independent	-.169	.112	-.066	-1.512	.131	-.390	.051
	Prop on Wknds	1.176E-04	.008	.000	.015	.988	-.015	.015
	Customers per week	.357	.109	.133	3.269	.001	.142	.572
	Chain-Driven Charbroiler	.663	.150	.144	4.411	.000	.367	.958
	N Charbroilers	4.329	.197	.711	21.942	.000	3.941	4.717
	How many deep-fat fryers?	-4.10E-02	.032	-.047	-1.275	.203	-.104	.022
	Q58. How many griddles or grills?	-4.50E-02	.022	-.066	-2.092	.037	-.087	-.003

a. Dependent Variable: Char total

Total Fried Meat

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.579[a]	.336	.309	.9114

a. Predictors: (Constant), Q58. How many griddles or grills?, Steak, How many deep-fat fryers?, City 500K+, American, Seafood, Prop on Wknds, N Charbroilers, Family, Italian, Chinese, log Employees on site, Mexican, Independent, Customers per week, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	166.192	16	10.387	12.505	.000[a]
	Residual	328.921	396	.831		
	Total	495.113	412			

a. Predictors: (Constant), Q58. How many griddles or grills?, Steak, How many deep-fat fryers?, City 500K+, American, Seafood, Prop on Wknds, N Charbroilers, Family, Italian, Chinese, log Employees on site, Mexican, Independent, Customers per week, Fast Food

b. Dependent Variable: Fry total

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-.203	.360		-.563	.574	-.910	.505
	Fast Food	-.473	.199	-.184	-2.382	.018	-.864	-.083
	Family	-.502	.206	-.150	-2.435	.015	-.908	-.097
	Seafood	.835	.286	.143	2.922	.004	.273	1.396
	Steak	-.239	.268	-.044	-.892	.373	-.765	.287
	American	-.326	.202	-.092	-1.615	.107	-.724	.071
	Chinese	.759	.204	.218	3.712	.000	.357	1.161
	Italian	-.186	.210	-.049	-.883	.378	-.599	.227
	Mexican	-.482	.186	-.161	-2.598	.010	-.847	-.117
	City 500K+	.212	.108	.083	1.971	.049	.001	.423
	log Employees on site	3.165E-02	.139	.012	.227	.820	-.242	.306
	Independent	.271	.131	.120	2.065	.040	.013	.529
	Prop on Wknds	-2.41E-02	.009	-.109	-2.591	.010	-.042	-.006
	Customers per week	.268	.130	.115	2.059	.040	.012	.524
	N Charbroilers	-.279	.227	-.053	-1.229	.220	-.726	.168
	How many deep-fat fryers?	.270	.039	.355	7.014	.000	.194	.346
	Q58. How many griddles or grills?	-6.11E-02	.026	-.102	-2.372	.018	-.112	-.010

a. Dependent Variable: Fry total

Total Grilled Meat

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.579[a]	.335	.306	.9980

a. Predictors: (Constant), Q58. How many griddles or grills?, Steak, How many deep-fat fryers?, City 500K+, American, Seafood, Prop on Wknds, N Charbroilers, Clamshell Griddle, Family, Italian, Chinese, log Employees on site, Mexican, Independent, Customers per week, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	197.492	17	11.617	11.664	.000[a]
	Residual	392.403	394	.996		
	Total	589.894	411			

a. Predictors: (Constant), Q58. How many griddles or grills?, Steak, How many deep-fat fryers?, City 500K+, American, Seafood, Prop on Wknds, N Charbroilers, Clamshell Griddle, Family, Italian, Chinese, log Employees on site, Mexican, Independent, Customers per week, Fast Food

b. Dependent Variable: Grill total

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-1.042	.395		-2.637	.009	-1.818	-.265
	Fast Food	.340	.218	.120	1.557	.120	-.089	.768
	Family	.455	.230	.124	1.981	.048	.003	.907
	Seafood	.109	.313	.017	.347	.729	-.507	.724
	Steak	.674	.296	.115	2.279	.023	.092	1.256
	American	.635	.224	.164	2.827	.005	.193	1.076
	Chinese	-1.44E-02	.225	-.004	-.064	.949	-.457	.428
	Italian	.180	.231	.043	.778	.437	-.274	.633
	Mexican	.593	.206	.182	2.883	.004	.189	.998
	City 500K+	9.778E-02	.118	.035	.830	.407	-.134	.329
	log Employees on site	.337	.153	.118	2.207	.028	.037	.637
	Independent	-8.84E-02	.144	-.036	-.615	.539	-.371	.194
	Prop on Wknds	-7.63E-03	.010	-.032	-.749	.454	-.028	.012
	Customers per week	.498	.144	.194	3.460	.001	.215	.780
	Clamshell Griddle	1.063	.214	.216	4.970	.000	.643	1.483
	N Charbroilers	-1.111	.249	-.192	-4.461	.000	-1.601	-.622
	How many deep-fat fryers?	-3.45E-02	.042	-.041	-.815	.416	-.118	.049
	Q58. How many griddles or grills?	.191	.028	.291	6.755	.000	.135	.247

a. Dependent Variable: Grill total

Total Meat, All Cooking Methods

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.595[a]	.354	.324	.6022

a. Predictors: (Constant), Q58. How many griddles or grills?, Steak, How many deep-fat fryers?, City 500K+, American, Seafood, Prop on Wknds, N Charbroilers, Clamshell Griddle, Family, Chain-Driven Charbroiler, Italian, Chinese, log Employees on site, Mexican, Customers per week, Independent, Fast Food

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	77.085	18	4.283	11.810	.000[a]
	Residual	140.698	388	.363		
	Total	217.783	406			

a. Predictors: (Constant), Q58. How many griddles or grills?, Steak, How many deep-fat fryers?, City 500K+, American, Seafood, Prop on Wknds, N Charbroilers, Clamshell Griddle, Family, Chain-Driven Charbroiler, Italian, Chinese, log Employees on site, Mexican, Customers per week, Independent, Fast Food

b. Dependent Variable: Question-based total

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-1.27E-02	.240		-.053	.958	-.485	.459
	Fast Food	8.696E-02	.133	.051	.655	.513	-.174	.348
	Family	-.173	.139	-.077	-1.242	.215	-.447	.101
	Seafood	.288	.189	.074	1.524	.128	-.083	.660
	Steak	.128	.179	.036	.715	.475	-.223	.479
	American	5.298E-02	.136	.022	.388	.698	-.215	.321
	Chinese	.135	.137	.058	.981	.327	-.135	.405
	Italian	-.300	.140	-.118	-2.140	.033	-.576	-.024
	Mexican	-5.39E-03	.125	-.003	-.043	.966	-.251	.240
	City 500K+	.174	.071	.102	2.440	.015	.034	.315
	log Employees on site	8.998E-02	.093	.052	.972	.331	-.092	.272
	Independent	.175	.089	.116	1.969	.050	.000	.350
	Prop on Wknds	-1.67E-02	.006	-.114	-2.713	.007	-.029	-.005
	Customers per week	.661	.087	.423	7.562	.000	.489	.833
	Chain-Driven Charbroiler	-5.31E-02	.121	-.020	-.439	.661	-.291	.185
	Clamshell Griddle	7.628E-02	.133	.025	.574	.566	-.185	.337
	N Charbroilers	.558	.157	.157	3.565	.000	.250	.866
	How many deep-fat fryers?	5.619E-03	.026	.011	.220	.826	-.045	.056
	Q58. How many griddles or grills?	-2.64E-03	.017	-.007	-.154	.877	-.036	.031

a. Dependent Variable: Question-based total

Appendix D—Restaurant Categories, Various Vendors